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INTEGRATED INFORMATION SYSTEM (IIS)
DETAILED SYSTEM IMPLEMENTATION PLAN

Prepared for

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

Second Report of Task Order No. 17

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1. INTRODUCTION

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This report is submitted in fulfillment of Task A.(4) of the Statement of Work under [redacted] Task Order No. 17, to provide a detailed system implementation plan for the Integrated Information System (IIS).

The plan which is described herein was selected from a number of alternative plans in order to meet the requirement for establishment of a National Data Base in approximately one year and to provide for a concurrent initial operational capability which would include as many of the features of the IIS as were deemed necessary and practical under budgetary constraints. Accordingly, the plan provides for a National Data Base, and capabilities for data entry, verifying, editing, approval, data base update, query, Presentation sheet generation and report generation within 14 months. The remaining capabilities of target prediction, scheduling, COINS interface, cables, and on-line support to 3rd phase reporting will be provided within an additional 9 months.

The detailed plan as presented in the following sections includes a description of program management, its organization, planning and implementation responsibilities (Section 2), implementation schedules and manpower requirements (Section 3), and implementation costs (Section 4). Appendices A, B, and C are concerned respectively with the selection of the implementation plan to be detailed, detailed data utilized in deriving schedules and a critical path analysis.

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2. PROGRAM MANAGEMENT

Management of the IIS program will require the coordination and control of activities jointly involving contractor personnel and personnel from several divisions of the Center. It is therefore essential for the orderly development of the IIS that an organization be established with clearly defined responsibilities and authority to manage the implementation of the IIS. A Program Office is proposed for this purpose which can be staffed, either by Center personnel, by contractor personnel, or both. In defining the responsibilities of the Program Office, we have assumed that some equipment will be procured under contract as opposed to entirely GFE, some software will be developed under contract rather than developed entirely by the Center, and that services in support of training and other functions may be acquired under contract.

2.1 Program Office Organization

A Program Office consisting of a Program Manager and three functional areas for Administration, Operations, and Engineering is recommended as shown in Figure 1. Administration is a staff function, and Operations and Engineering are line functions. The operations functions are connected by a dashed line since it is deemed highly desirable that these functions be staffed by Center operational personnel even if program management is accomplished with contractor assistance.

2.2 Program Office Functions

The function of each area within the Program Office is described in terms of its planning and implementation responsibilities. The planning responsibilities are concerned with the preparation of specific plans. All plans are identified, but it should be noted that many of the procedures called for in these plans now exist at the Center. A determination as to which of the Center procedures to use and which to prepare will depend on Center policies and assignment of management responsibility for program office functions. Where plans must be prepared, work must be initiated immediately upon start of the implementation phase of the IIS program. The implementation responsibilities are concerned with execution of the plans. Since implementation actions may involve the participation of several functional areas, a summary of responsibilities by functional area and their interrelation for implementation actions is shown in Table I.

2.2.1 Administration

The responsibilities in this area include program control, status reporting, configuration control, procurement, reliability and maintainability control, facility modifications and use of Center equipment for IIS development.

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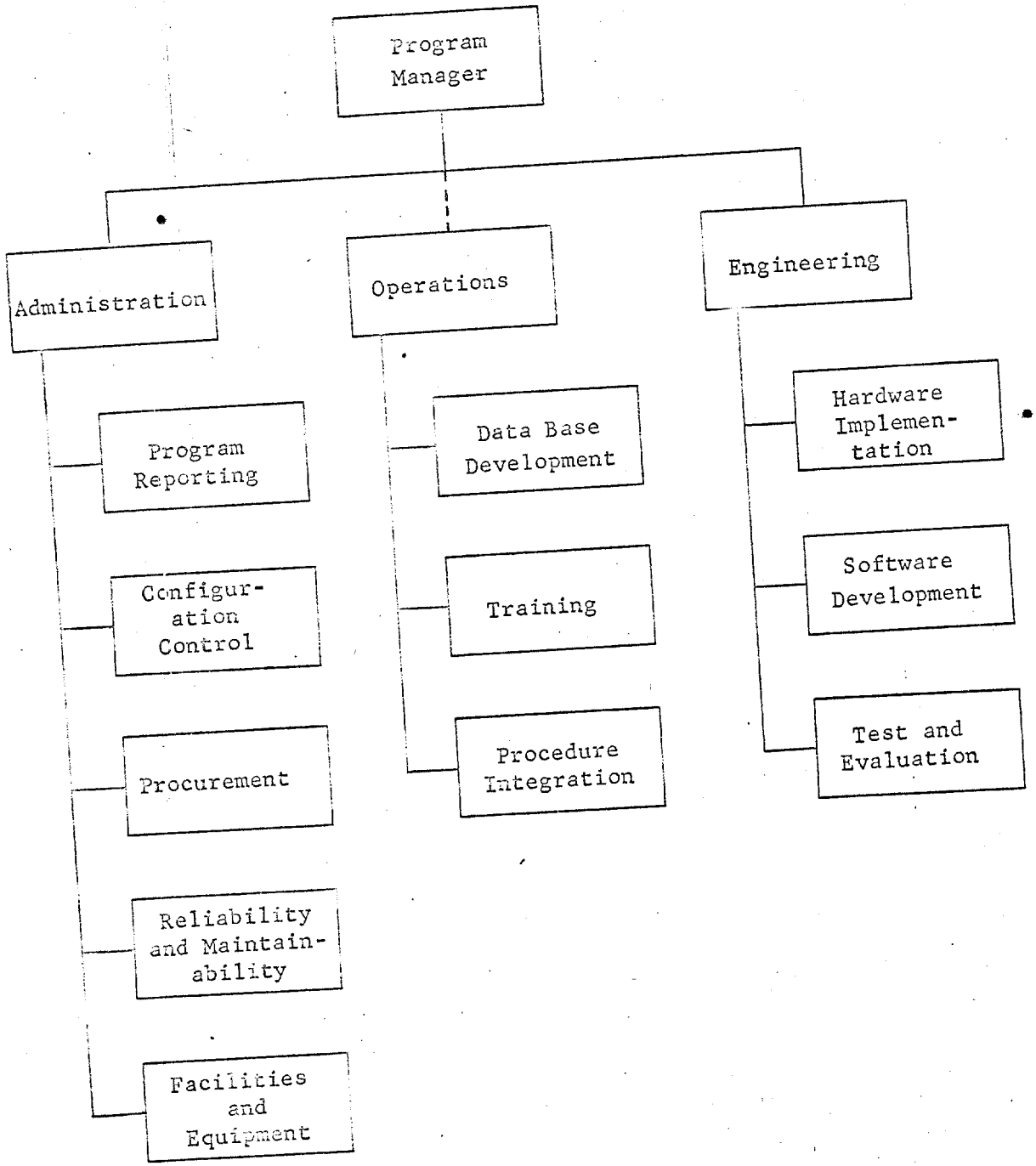

Figure 1 Program Office Organization

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TABLE I

IMPLEMENTATION RESPONSIBILITIES AND RELATIONSHIPS

IMPLEMENTATION ACTION \ FUNCTION	ADMINISTRATION						ENGINEERING			OPERATIONS				Contractor and In-House Efforts
	Program Reporting	Procurement	Configuration Control	Facilities and Equipment	Reliability and Maintainability	Supervision	Hardware Implementation	Software Development	Test and Evaluation	Supervision	Data Base Development	Training	Procedures Integration	
GENERAL IMPLEMENTATION RESPONSIBILITIES														
Component Acquisition	Cost and Status Report'g	Contract Support	System Design Control	Modification and Use	R&M Monitoring	Coordination	Hardware Monitoring	Software Monitoring	Quality Assurance	Coordination	DB Conversion	Conduct of Training		Component Production
System Conversion	Cost and Status Report'g					Component Acceptance				Support Acceptance	DB Acceptance	Training Completion	IIS Capability Use	
Cost/Benefit Analysis	Analysis		Cost Recording										Benefit Recording	
SPECIFIC IMPLEMENTATION RESPONSIBILITIES														
CONTRACT AND IN-HOUSE SUPPORT														
Specifications Release			Release		Approval	Approval				Approval				
RFP Preparation (Contract Only)		Selection of Vendors				Coordination				Coordination				
Proposal Evaluation (Contract Only)		Contractor Selection				Technical Review				Technical Review				
Performance Monitoring	System Cost and Progress		Production Progress	Hardware Installation	R&M Attainment		Hardware Production	Software Production			DB Conversion	Training		
Contractor and In-house Effort Support		Administrative Support	Spares R'qmt. Eval.	Use of Center Equip.			Technical Support	Technical Support			Technical Support	Technical Support		
Component Acceptance					R&M Acceptance	Component Acceptance			Acceptance Testing	Service Prod. Acceptance				
Documentation Acceptance			FACI											
CHANGE CONTROL														
Change Proposals	Entry of External Policies		Impact Study Referral				Hardware Proposal Review	Software Proposal Review	Proposal Submission		Proposal Submission	Proposal Submission		Proposal Submission

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TABLE I (Cont.)

IMPLEMENTATION RESPONSIBILITIES AND RELATIONSHIPS

FUNCTION / IMPLEMENTATION ACTION	ADMINISTRATION						ENGINEERING			OPERATIONS				
	Program Reporting	Procurement	Configuration Control	Facilities and Equipment	Reliability and Maintainability	Supervision	Hardware Implementation	Software Development	Test and Evaluation	Supervision	Data Base Development	Training	Procedures Integration	Contractor and In-house Efforts
SPECIFIC IMPLEMENTATION RESPONSIBILITIES (CONT'D)														
Change Approval			Review Board Action	Installations Review	R&M Review		Hardware Impact Study	Software Impact Study		Operations Review				
Change Integration			Change Recording	Plan Update		Reengineering Effort	Specification Update	Specification Update	Plan Update		Plan Update	Plan Update		Change Incorporation
TESTING Test Procedures Development					Manual Backup Proced.	Eng. Approval	Input to Hardware Tests	Input to Software Tests	Cat. II and III Proced.	Operations Approval		Training Procedures		Cat. I Procedures
Category I Tests					Failure Analysis				Evaluation					Execution
Category II Tests					Failure Analysis				Execution and Eval.		Data for Use in Tests			
Category III Tests					Backup Test Eval.				Execution	Evaluation		Training Test Eval.		
EQUIPMENT INSTALLATION AND USE OF CENTER EQUIPMENT Facility Modification	Status Reporting			Scheduling and Follow Up		Request Submission			Request Submission			Request Submission	Request Submission	
Use of Center Equipment				Coordination					Request Submission			Request Submission	Request Submission	Request Submission

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2.2.1.1 Program Reporting

Planning Responsibilities

The required IIS Implementation Schedule and Manpower Requirements plans have been completed and are presented in detail in Section 3 of this report.

Implementation Responsibilities

This functional area is responsible for providing status reports on the overall IIS implementation, manpower utilization, contractor progress, program costs, and other data of management interest for control purposes.

The Critical Path Method (CPM), as used in the Center, is the management technique employed for planning and scheduling. Its employment for monitoring the IIS or modification of implementation plans or schedules as the result of approved configuration changes, revised funding, manpower availability, or policy decisions will be the responsibility of this functional area.

It is recommended that this area be responsible for a task to assemble cost/effectiveness data during final stages of IIS implementation and to compare this data with cost/effectiveness data of the current system, the extrapolated current system, and the present IIS design.

2.2.1.2 Configuration Control

"Configuration Management" is the management of technical requirements which define system equipment, software, products or services, and changes thereto. It is implemented through procedures by which uniform and mutually supporting methods for configuration identification, control and accounting are established and maintained for components of the system. The technical requirements include the requirements for engineering data, drawings, training and maintenance manuals pertinent to the system components.

Planning Responsibilities

A detailed set of Program Office procedures should be developed by this function to prescribe methods of component identification (numbers), control of change to the IIS baseline configuration during implementation, and configuration reporting and accounting. Required forms should be designed and made available for use.

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Implementation Responsibilities

Throughout the implementation, this function should be responsible for:

1. Acquiring and analyzing information concerning the impact of a Change Proposal originating in one Program Office function on other activities.

2. Presenting Change Proposals and associated impact evaluations to a Change Control Board for approval.

3. Ensuring that appropriate changes are incorporated in related efforts when a Change Proposal is approved.

4. Verifying change implementation.

5. Maintaining an updated record of current configuration status and records concerning approved changes to the baseline configuration.

6. Conducting First Article Configuration Inspections (FACI) to ensure that components and documentation are complete.

7. Maintaining records of tests and inspections of components.

8. Reporting on, and accounting for, configuration status.

2.2.1.3 Procurement

It is held likely that the procurement of long-lead time equipment and contractor support in software development will be initiated within the Center prior to the formal establishment of an IIS Program Office. Under these circumstances, it may be expedient to continue this method of meeting Program Office procurement responsibilities. Nonetheless, to ensure that the procurement responsibilities are met, the responsibilities under this concept of a Program Office are defined below:

Planning Responsibilities

This function should initially investigate the availability of GFE and in-house capability to meet IIS requirements. When the requirements for contractor support have thus been defined, this function should be responsible for preparation of the technical portion of RFP's to solicit contractor bids, including a statement of constraints on the use of other

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than Center facilities in testing. The technical portion of the RFP's will be based on information as released by the Configuration Control function.

Implementation Responsibilities

With the start of work on contract end items, the procurement function should provide contractors with the necessary forms and procedures to be employed in:

1. Submitting Change Proposals
2. Reporting compliance with approved changes.
3. Category I test reporting
4. Requests for facility modification
5. Requests for temporary use of Center facilities in testing.

This function will also be responsible for monitoring contractor progress to ensure timely delivery of contract end items and for administrative support to contractors in contract matters.

2.2.1.4 Reliability and Maintainability

The reliability of the IIS will be achieved by a highly reliable set of automated procedures, where automation can be effectively employed, backed up by manual procedures. The Reliability and Maintainability function of the implemention Program Office thus becomes concerned with both the reliability and maintainability of equipment and software and the reliability of the backup procedures.

The reliability of the automation will be jointly determined by the reliability of the hardware and software. IIS hardware specifications establish the minimum MTBF's for equipment and the procedures by which each potential vendor must determine the reliability of each piece of equipment.

Equally important is the contribution that can be made to system reliability through the proper application of software redundancy and diagnostic routines. Certain of these techniques have been included in the IIS design to insure the integrity of the IIS data base and approval procedures, but their potential value in other areas will undoubtedly come to light as a result of software development and experience with testing and initial operation of the IIS. When recognized they should be evaluated and, if practical, incorporated.

Finally, some testing of manual backup procedures should be accomplished to insure their effectiveness.

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Planning Responsibilities

A plan should be developed for monitoring and reporting adherence to, and improvement in, reliability and maintainability of the automated IIS procedures, and testing of manual backup procedures. The procedures for measuring reliability and maintainability of automated IIS procedures should be developed, and procedures to be employed in evaluating proposed software diagnostic subroutines should be described.

Implementation Responsibilities

Throughout the implementation, this function will be responsible for:

1. Analysis of equipment failures to ensure the accuracy of vendor MTBF data.
2. Analysis of effects of possible equipment failures on system operation. All these effects should be categorized according to severity to govern consideration of remedial action.
3. Analysis of the feasibility and advisability of including additional software diagnostic subroutines.
4. Evaluation of proposed configuration changes from system reliability and maintainability standpoints.
5. Continuous analysis of the requirements for equipment spares.
6. Scheduling, coordinating and evaluating tests of critical backup procedures.
7. Reporting of reliability and maintainability achievement.

2.2.1.5 Facilities and Equipment

It is essential that facility modifications be scheduled and effected in sufficient time to permit installation of equipment in accordance with plans for system implementation. These modifications may include wiring installation, relocation of partitions and existing equipment, and/or reallotment of space. Existing procedures in arranging for the temporary use of Center equipment should be reviewed and, if necessary, revised to allow for IIS implementation requirements.

Complete identification of facility modification requirements may be delayed until initial procurement action is approved and the equipment complement to be installed is firm. Information concerning installation requirements (wiring, space, floor-loading) should be obtained in proposals or through early coordination with the selected vendor to permit facility modification planning.

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The configuration of the UNIVAC 494 computer may be so unique or security constraints so rigorous that some Category II testing (by the contractor) may have to be accomplished on the Center equipment. The procedures for initiating requests for the use of this equipment including any required forms, should be established for use in procurement activities.

Planning Responsibilities

Prior to, or in the early stages of IIS implementation, this function should:

1. Develop the procedures to be employed by contractors in requesting use of Center equipment for Category II tests.
2. Provide a description of the installations requirements data to be acquired from vendors of equipment.
3. Prepare a basic schedule for the modifications to facilities.
4. Provide a tentative schedule for the use of Center equipment by contractors for test purposes.
5. Arrange for the acquisition or temporary use of any equipment required in IIS training.

Implementation Responsibilities

During the implementation period, this function will monitor facility modifications and take any necessary action to insure facility readiness for installation of IIS equipment. On request from contractors or in support of in-house efforts, it will arrange for the use of Center equipment for test purposes.

2.2.2 Operations

Within the Operations area of the Program Office there must be a supervisory function, a data base development function, a training function, and a procedures integration function. The supervisory function controls the activities of the other three, provides general coordination with Engineering and Administration and is specifically responsible for:

1. Determining in-house capability to handle manual data base conversion and training, and submitting recommendations for contract support in these areas.

2. Preparation of the technical requirements for RFP action to obtain contractor services.

3. Contractor proposal evaluation

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4. Determining the type and number of Center personnel to be given additional IIS training, and the requirements for new skills.

2.2.2.1 Data Base Development

In the implementation of the IIS, there is a requirement to convert historical data in the existing data base into the form required by the IIS. Certain data in current records can be automatically converted to IIS format. Other data, buried in free text in existing records, must be manually extracted, reformatted, abstracted (in certain cases), and then entered into the IIS to make it available, on a selective basis, in response to queries and for use in reports and Presentations.

The selection of data to be converted by manual techniques is a Center decision. This decision must involve consideration of the length of the records to be maintained in the data base, the parameters to be converted, and the cost/benefits of a conversion. It is also expected that decisions as to the degree of conversion may be affected by deliberations on the national level.

For the purpose of this plan, it is assumed that desired portions of each unit record which cannot be automatically converted will be converted manually under plans and procedures generated by the Data Base Development function.

Planning Responsibilities

The Data Base Development function should prepare a time-phased plan for data base conversion. This plan should include:

1. A listing of the items in the records to be automatically converted, the current file format, and the IIS file format. (Provided to engineering)

2. A listing of the items to be manually converted, the current file format, and the IIS format.

3. Establishment of standardized terms and codes to be utilized in IIS files.

4. The proposed period for completion of manual conversion and the estimated manpower requirements.

5. A schedule for the conversion of records to coincide with implementation plans for IIS capability implementation.

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6. A rationale for the removal of historical data from drum to tape (and to hard copy, if applicable) storage. This should be specified by record class and file sector.

7. Milestones in the data base development program for the creation and use of additional files.

Implementation Responsibilities

The primary concern of the Data Base Development function during implementation will be the actual conversion of the existing data base. However, it will additionally be responsible for:

1. Maintaining and updating the standards required to insure the integrity of the growing data base.

2. Developing methods of converting data from new sources to IIS format.

3. Preparing test data required by the test and evaluation function.

4. Interpreting higher echelon directives concerning reporting in terms of data base file structure requirements.

5. Reviewing change proposals which affect data base utility and providing a comprehensive analysis of effects on the current implementation program.

6. Coordinating with the development of software as required to handle revisions to data base conversion resulting from approved engineering changes.

7. Reporting of achievement in data base development.

2.2.2.2 Training

New equipment and new procedures which are incorporated in IIS design will require training of Center personnel, and some personnel of external agencies, in the following areas:

1. Use of the new Presentation and Worksheets in reporting.

2. Use of the query console, including console operation and dialogue with the data base (extended to query stations in external agencies).

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3. Data entry.

4. Use of the VEA console.

5. Film control.

6. Data base maintenance (manual input).

7. Equipment maintenance and repair.

8. Manual back-up procedures.

The training programs should be geared to the provision of trained personnel required when a given IIS capability is implemented. Further, the programs should be developed for use in training new personnel subsequent to the implementation period. The training of external personnel may be accomplished through participation in Center programs or through external training programs, whichever is desirable.

Planning Responsibilities

A training plan should be prepared, supplemented by necessary training manuals, aids, and other material for each of the areas listed above. These plans should include a description of the IIS concepts involved, training schedules and tests, identification of critical training requirements, and the instructor, equipment and space requirements.

Implementation Responsibilities

In addition to the routine conduct of training and tests, this function will be responsible for:

1. Evaluating the impact of proposed engineering changes on current and completed training programs, including modifications and retraining requirements.

2. Proposing changes in IIS procedures where unanticipated human factors problems arise during training activities.

3. Modifying training programs as necessary to support approved design changes.

4. Monitoring the operational use of IIS procedures to determine training improvements and to update training manuals for future use.

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5. Coordinating training of external personnel.

6. Reporting training achievement.

2.2.2.3 Procedures Integration

The IIS implementation plan introduces improved IIS capabilities into Center operation as soon as these capabilities are operational (Category III testing completed). At any point in the implementation period after the first IIS capability has been introduced, the Center will be operating with a mixture of IIS procedures and those employed previously. Integration of these procedures must be assured.

An additional integration problem lies in the fact that implementation of full IIS benefits may depend on manual data base conversion rates. While the IIS procedures can operate with that portion of the data base which can be converted to IIS format automatically, the full benefits of the query capability may have to await manual data conversion on a target by target, team by team, or some other expansion basis. Interim methods of operation, where the full IIS capability does not exist, should be developed.

Planning Responsibilities

While the major problems in procedures integration have been considered in developing the overall implementation plan, the procedural details of operation with a mixture of IIS and current procedures must be developed, including the requirements for temporary use of additional personnel, if any, during this operation. In addition, a method of recording statistical data which can be analyzed to determine the actual benefits of IIS procedures should be developed.

Implementation Responsibilities

During the implementation period, the Procedures Integration function should monitor the implementation and expansion of IIS capabilities and should additionally:

1. Monitor system operation with current procedures to develop statistical data on throughput, times, manpower utilization, and other factors for Center activities in which IIS procedures will be employed.

2. Monitor system operation in activities in which IIS procedures have replaced other procedures to acquire statistical data for comparison with that developed in 1, above and to assure that the operational IIS satisfies the Center requirements.

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3. Modify the procedures integration plan in accordance with approved engineering changes and any resulting changes in Data Base Development and Training plans.

4. Provide progress reports on IIS implementation reporting any areas where operational deficiencies are noted.

5. Provide a final report on benefits of the implementation.

2.2.3 Engineering

The Program Office functions in this area include a supervisory function, a hardware implementation function, a software development function, and a test and evaluation function. The supervisory function controls the activities of the other three, coordinates with Operations and Administration, and is specifically responsible for:

1. Determining in-house capability for software development and recommending the level of contract assistance to be procured.

2. Technical approval of hardware and software specifications.

3. Review of contractor proposals to provide hardware or software and make recommendations for vendor/equipment selection.

4. Technical acceptance of IIS engineering components.

2.2.3.1 Hardware Implementation

The hardware in the IIS design consists of the central processor, peripheral equipment, and a number of remote consoles and data entry devices. The central processor and peripheral equipment employed in current processing will be employed in IIS operations although some augmentation will be required. However, equipment which will be identical to that in current inventory is assumed to be subject only to acceptance testing, while the remote consoles and data entry devices will be subject to standard engineering procurement procedures. The Hardware Implementation function will, under the above constraint, be responsible for the adequacy of the hardware components.

Planning Responsibilities

The Hardware Implementation function will be governed by the general implementation plan and the plans for equipment testing developed by the Test and Evaluation function.

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Implementation Responsibilities

This function will be responsible for:

1. Technical assistance to equipment vendors.

2. Monitoring of vendor performance in provision of IIS equipment including central processor and peripheral augmentation components.

3. Review and approval of engineering change proposals submitted by equipment contractors.

4. Determining the impact of change proposals initiated by other functions on the acquisition of IIS hardware.

5. Assistance to the Configuration Control function in First Article Configuration Inspections (FACI).

6. Submitting recommendations for acceptance of equipment components.

7. Provision of installation requirements involving modification of facilities to the Facilities and Equipment function.

8. Reporting on equipment acquisition.

2.2.3.2 Software Development

A high degree of coordination must be maintained in the development of IIS software packages to ensure compatibility in the operational support which they provide. In addition, in the phased implementation of individual IIS capabilities, portions of a particular program package may be operationally required much sooner than other portions of the same package. The Software Development function will provide this coordination.

A requirement will also exist for IIS design modification to accommodate optional methods of coding software packages and modifications to system requirements. The Software Development function should be staffed to provide these interpretations in any software area.

Planning Responsibilities

The Software Development function will operate under the provisions of the general implementation plan and the plans for testing produced by the Test and Evaluation function. There is no requirement for production

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of a special plan for this function. A limited amount of planning activity will be required in the provision of input to plans generated by other functions.

Implementation Responsibilities

This function will be responsible for:

1. Technical assistance to contractors, including modification of the IIS design concepts.

2. Review and approval of change proposals submitted by software developers (in-house or contractors).

3. Determining the impact of change proposals initiated by other functions on the software development program .

4. Verifying that appropriate changes in software are effected in support of approved changes in the IIS design.

5. Arranging for the use of Center facilities when required for software checkout and test.

6. Submitting recommendations for software acceptance.

7. Reporting achievement in the development of software.

2.2.3.3 Test and Evaluation

The IIS design includes an intricate combination of hardware and software operating on an extensive, structured, data base. It is essential that tests be conducted prior to operational use of components in routine system operation to ensure:

1. Compliance with specifications for production of end items.

2. Compatibility in interactions with other components.

3. Performance in providing a system capability which can be effectively employed by Center personnel.

The three levels of testing described above are designated Category I, II and III tests, respectively. Category I tests will be performed by

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contractors or the in-house effort charged with production of the end item. Category II tests will be directed and evaluated by the Test and Evaluation function. Category III tests will be executed by this function, but results will be evaluated by the Operations function. The Test and Evaluation function will nevertheless be responsible for establishing test objectives, procedures, and reporting requirements and for analysis of test results.

Planning Responsibilities

As an initial implementation effort, the Test and Evaluation function should prepare:

1. The overall test plan describing:
   a. Hardware to be tested
   b. Software to be tested
   c. Test schedules
   d. Test objectives, where applicable, for reliability, maintainability, quality, compatibility and human factors.
   e. Required test environments.
   f. Test plan approval procedures
   g. Test reporting
   h. Acceptance procedures
2. A detailed description of test data required in Category II and III tests (for submission to Data Base Development function).
3. A schedule of requirements for the use of Center equipment in testing (for submission to the Facilities and Equipment function).

Implementation Responsibilities

During implementation, this function will be responsible for:

1. Preparation of test procedures for each of the scheduled tests. These procedures should detail any simulations to be employed in lieu of actual operation.
2. Modifying test procedures to conform to approved engineering changes.

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3. Monitoring Category I tests performed by contractors or in-house evaluating results, and reporting on conformance with component specifications.

4. Executing Category II tests, evaluating results, and submitting engineering change proposals as necessary.

5. Conducting Category III tests and summarizing test results for acceptance action.

6. Reporting test and evaluation achievement.

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3. SCHEDULES AND MANPOWER LOADINGS

Discussions between NPIC and [redacted] personnel concerning the various implementation plans outlined in Appendix A resulted in a decision to provide schedules and costs (including manpower loadings) for a system which would permit on-line access to the IDF and associated subfiles by intelligence community personnel, both inside and outside the Center, in approximately 14 months after the beginning of the major implementation effort. Capabilities of this First Operational Phase include real-time queries of the IDF, the use of the Presentations and Worksheets, and the automatic preparation of First and Second Phase Reports. 25X1A

The Prediction and Assignment functions to be used in the scheduling of First and Second Phase Readout and to assist in film distribution are added to create a Second Operational Phase. Automatic processes to aid in the production of Third Phase Detailed Reports and the equipment to support them are introduced to create the Third Operational Phase. As shown in Figure 2, certain tasks must be completed before others can be undertaken, and operational capabilities will become available only upon the completion of various sets of tasks. It should be noted that this figure shows only the prerequisites for the accomplishment of certain tests on the attainment of the various Operational Phases and the month (in circles on the diagram) after start of implementation when that task is to be complete. Details of the schedules and manpower loadings for their accomplishment are provided in the remainder of this report and its Appendices.

The implementation plan selected required approximately 36 people to prepare, test and document computer programs, and to assist in the conduct of Category III (Operational) Tests involving these programs. Staffing of the Program Office described in Section 2 of this report is subject to Center organization and policy, therefore, no manpower estimates for that activity have been included.

3.1 Software Development Schedule

Figure 3 is a bar chart illustrating the level of effort (in numbers of people) required to develop and test the various computer program packages necessary for system operation.

The software development schedule provides for the creation of 13 program packages. Eleven of these packages correspond directly to eleven of the twelve software specifications provided by the contractor as part of the design documentation. The program package entitled "Miscellaneous Utility Programs" includes the specification for "Data Base Maintenance and Periodic Update" and additionally provides time and manpower to cover unforeseen contingencies in adapting programs to RUM System requirements.

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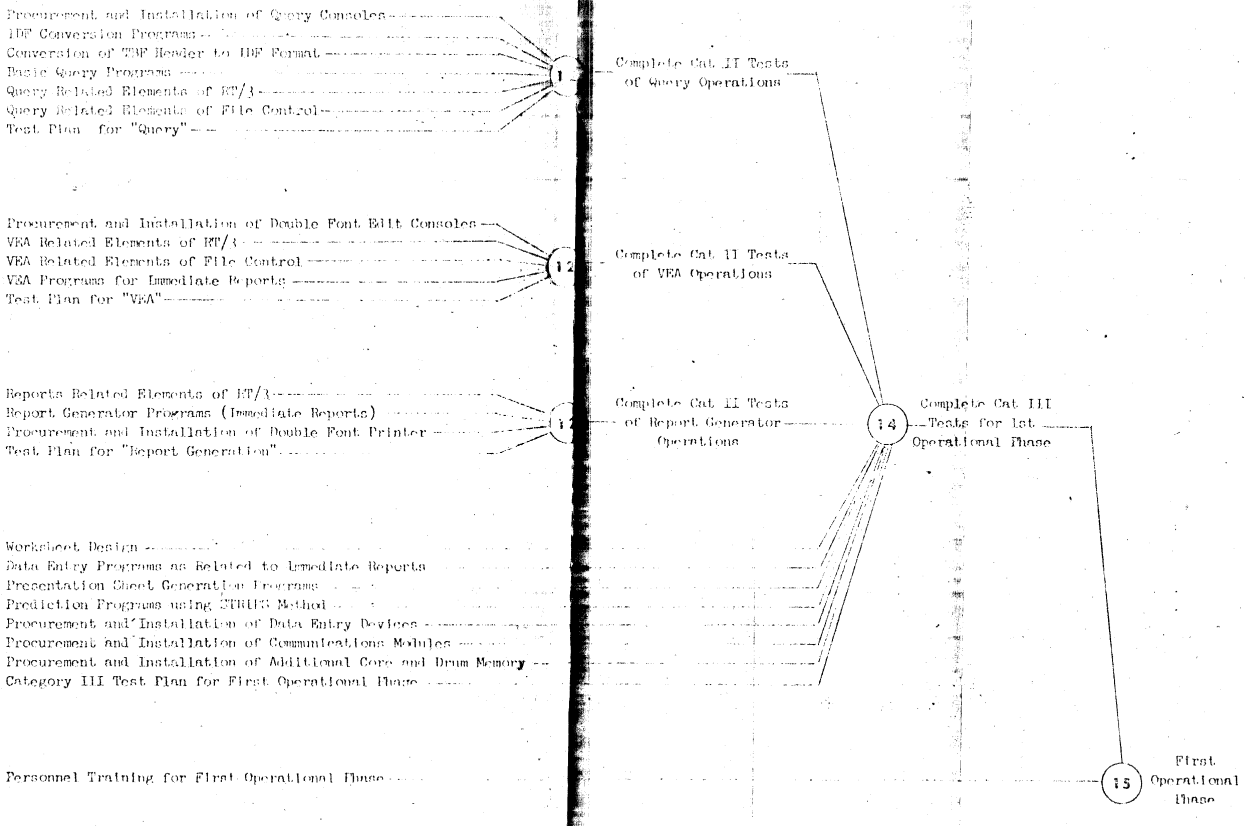

Figure 2 Prerequisites for the Implementation of IRS Capabilities (1 of 2)
(First Operational Phase)

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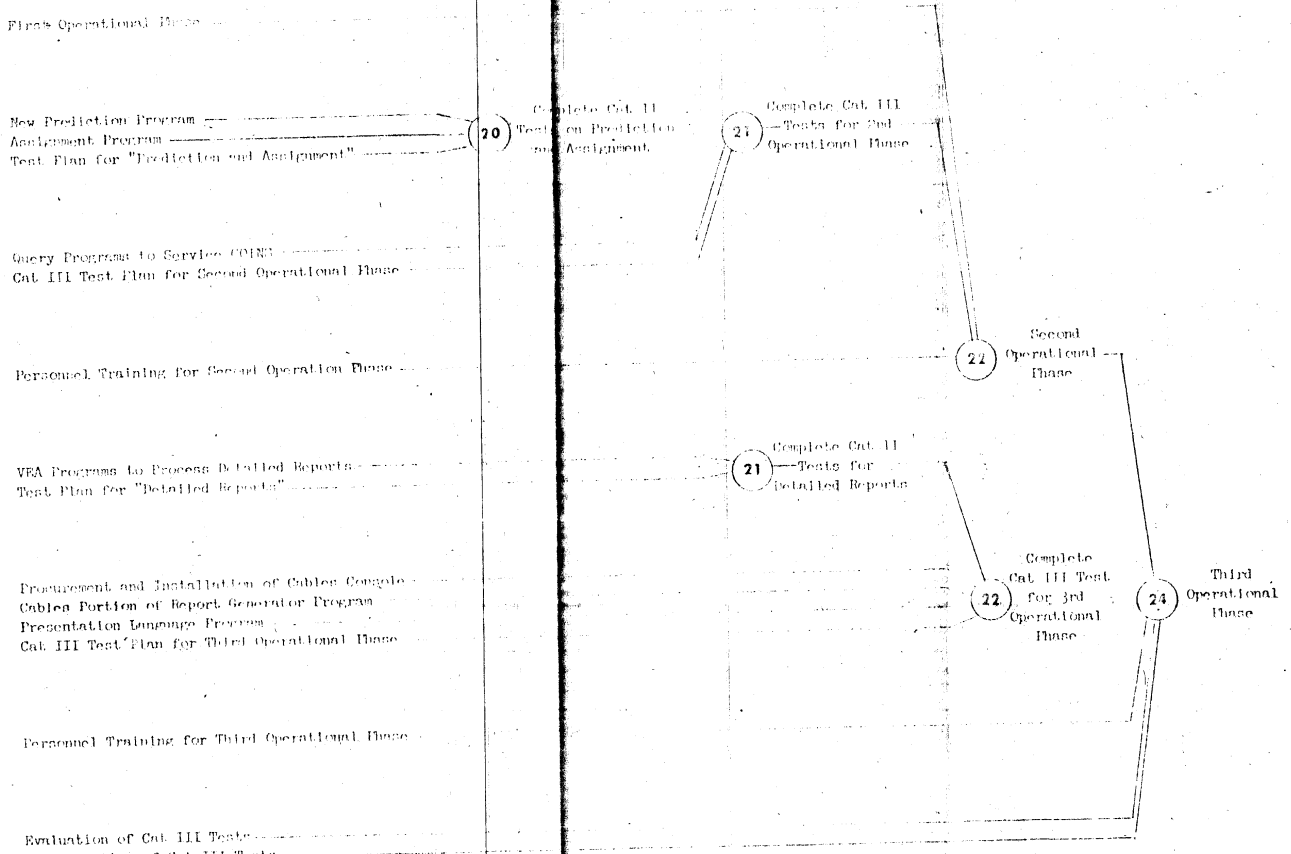

Figure 2 (Cont'd) Prerequisites for the Implementation of IIS Capabilities (2 of 2)
(Second and Third Operational Phases)

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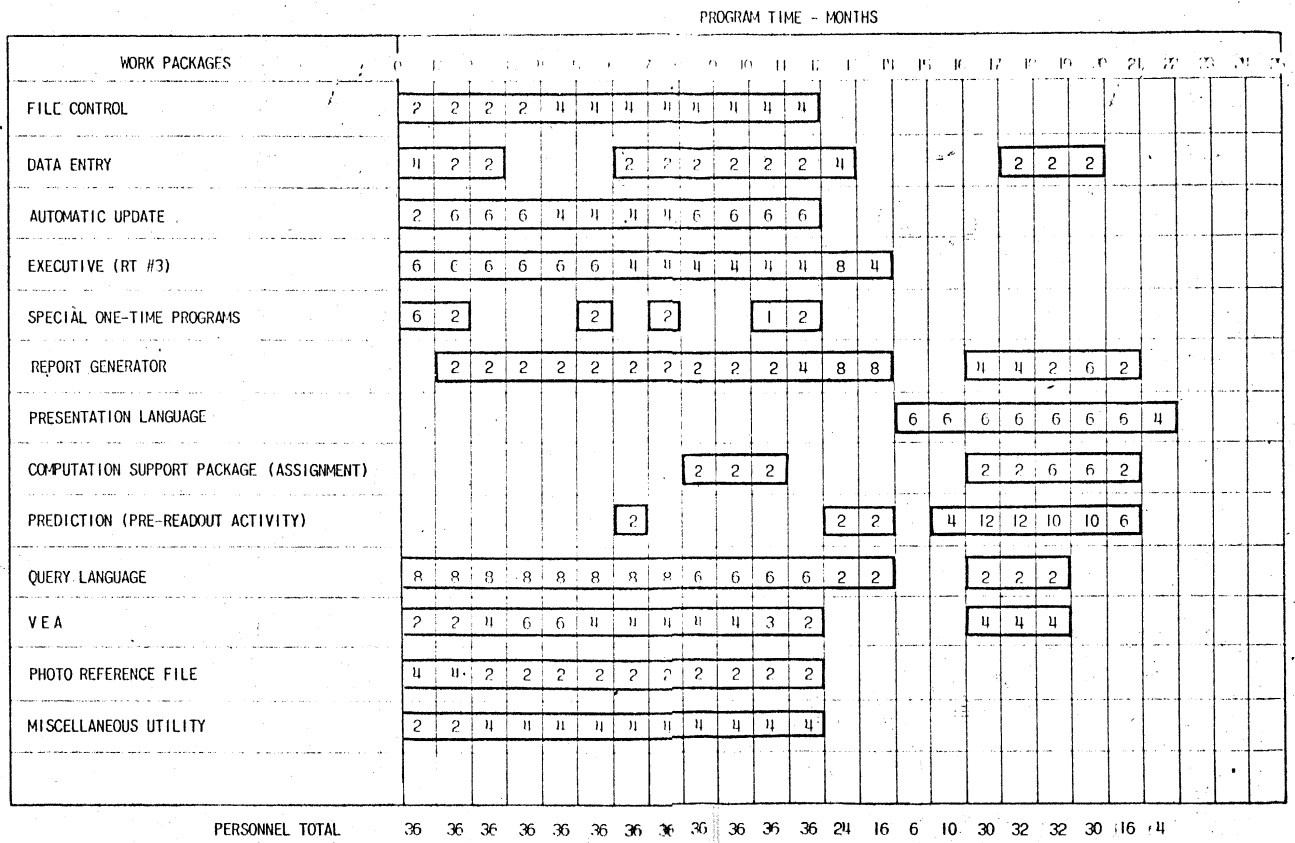

Figure 3 Software Development Schedule

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Additionally, we have provided manpower and time for the creation of special "One-time" programs which may prove desirable in data base conversion and for similar purposes.

It will be noted that, in some cases, manpower is provided beyond the date when a program is scheduled for completion in Figure 2. This additional effort will be used to assist in the Category II and Category III testing which involves the particular program.

Some program packages are longitudinally divided. This division has been made to assist in maintaining a balanced work load and is feasible because some aspects of the programs are not required until the Second and Third Operational Phases.

Appendix B of this volume contains the set of Implementation Planning Sheets which further define the specific efforts undertaken in each program package. Relationships among the packages and their various segments are shown in the Arrow Diagram and CPM analysis in Appendix C.

3.2 Hardware Procurement Schedule

Figure 4 illustrates a basic procurement cycle which starts at the time of the approval and release of the specifications and ends at the completion of the Category II tests. The elapsed time interval between the signing of the contract and the delivering of the equipment is, of course, dependent upon the particular item that is being procured.

Figure 5 illustrates the application of this basic procurement cycle to the particular needs of the IIS Implementation Plan. The Hardware Procurement Schedule considers only those items of hardware which are not currently at the Center. It is the intent of the Implementation Plan to develop system capabilities as fully as possible, at the earliest possible date; the procurement schedule reflects this intent by scheduling delivery of all required hardware items of a given type at the same time.

The critical item for procurement is the Double Font Edit Console. If First Operational Phase capability is to be attained in 14 months, procurement of these devices must be initiated two months in advance of the start of other implementation activities.

It will also be noted on Figure 5 that no preliminary procurement cycle is provided for equipment directly available from UNIVAC for use with the central computer. It is assumed that the Center has a standard contract with this vendor and can place an order as soon as funds are available.

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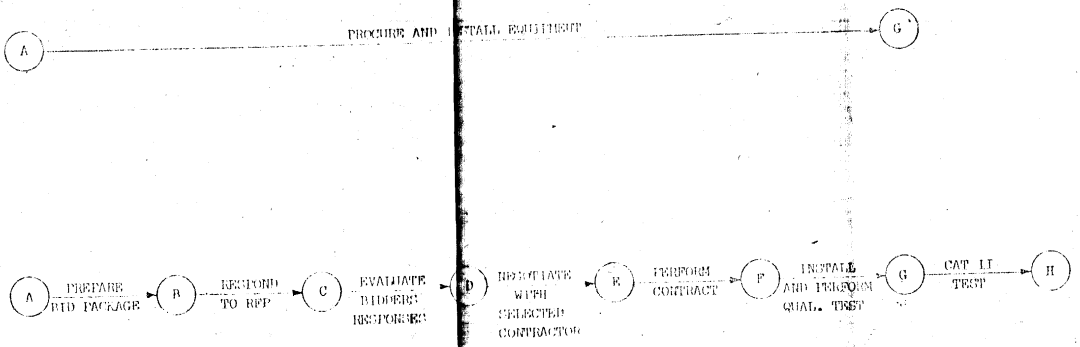

MILESTONES

A -- RELEASE SITED.
B -- RELEASE BID PACKAGE
C -- RECEIVE BIDS
D -- WINNER SELECTED
E -- CONTRACT SIGNED
F -- EQUIPMENT DELIVERED
G -- QUALIFICATION TEST COMPLETED
H -- CATEGORY II TESTS COMPLETED

TIMING IN MONTHS

TASK	TIME
A-B	1/2
B-C	1-1/2
C-D	1-1/2
D-E	1-1/2
E-F	VARIES
F-G	1
F-H	VARIES
A-G	VARIES

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Figure 4 Basic Procurement Cycle

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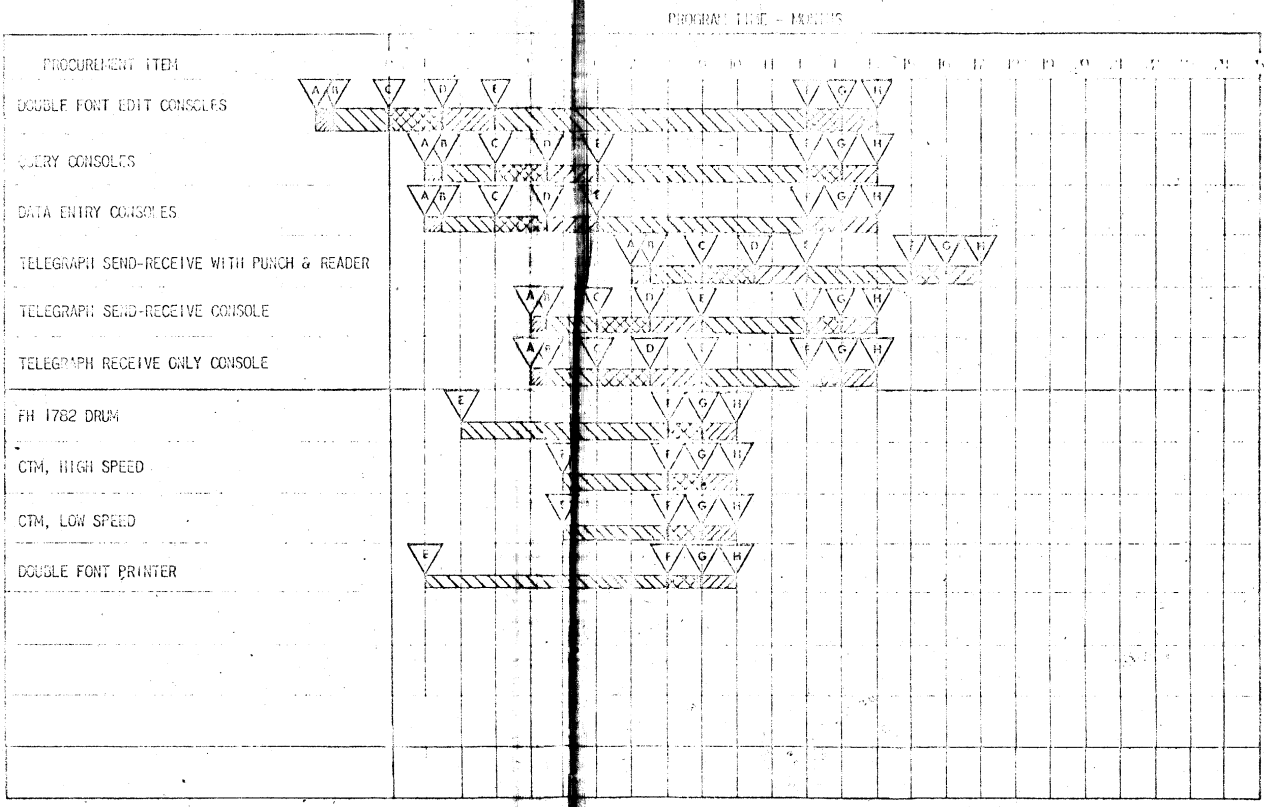

Figure 5 Hardware Procurement Schedule

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3.3 Training Schedule

Figures 6 and 7 illustrate a basic training cycle and a training schedule designed to meet the requirements of the implementation plan. The training program must be integrated with the normal work schedules of Center personnel and will be planned so as not to interfere with their normal duties.

3.4 Test and Evaluation Schedule

Figure 8 illustrates the basic events and milestones in a typical Test and Evaluation Cycle. Category I Tests are component tests and are performed by the component supplier. Category II Tests are subsystem tests and, in this Implementation Plan, evaluate the combinations of equipment, programs and files which jointly provide a specific capability (e.g., the ability to query the data base in real-time). Category III Tests are operational tests using Center personnel.

Figure 9 provides schedules for the preparation of test procedures and the conduct of tests in both Category II and Category III. Preparation of the plans is a Program Office function, therefore, no manpower loadings are provided. However, conduct of these tests will require support from programming personnel as indicated (in terms of numbers of people) on the diagram.

3.5 Documentation Schedule

Figure 10 provides schedules for the preparation of the final documentation of the capabilities tested in Category II and Category III tests. This documentation will be completed as specified in the technical requirements prepared by the Configuration Control function of the Program Office.

The estimated number of Center software development personnel that will be required to directly support the various documentation tasks are included within the bars for each month. The total number of Center software development personnel required in each month is shown as the bottom line of the chart.

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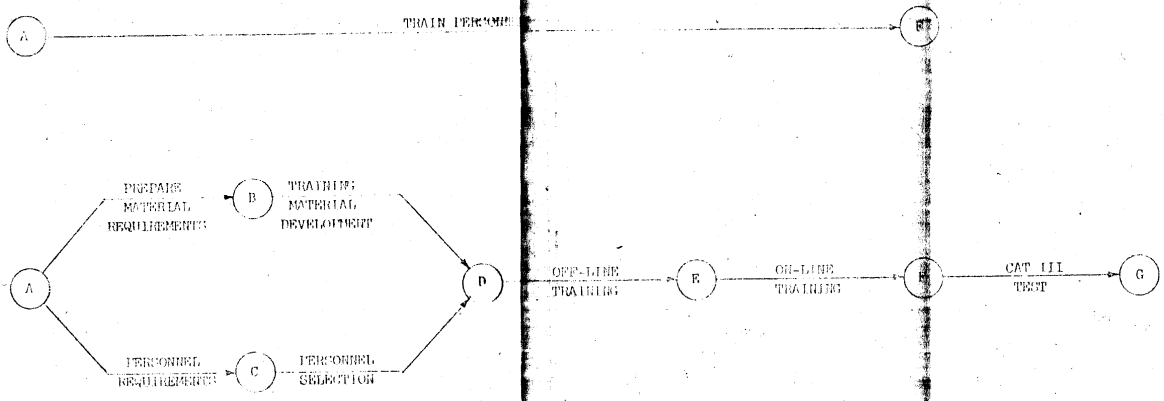

MILESTONES:

A -- RELEASE TRAINING REQUIREMENTS
D -- START TRAINING PERSONNEL
E -- START ON-LINE TRAINING
F -- COMPLETE TRAINING PROGRAM
G -- START OPERATIONAL USE OF SYSTEM

CRITICAL PATH

A, B, D, E, F, G

TIMING IN MONTHS

TASK	TIME
A-B	1/2
A-C	1/4
B-D	6
C-D	1/2
D-E	2
E-F	1/2
F-G	VARIES
A-F	9

Figure 1 Basic Training Cycle

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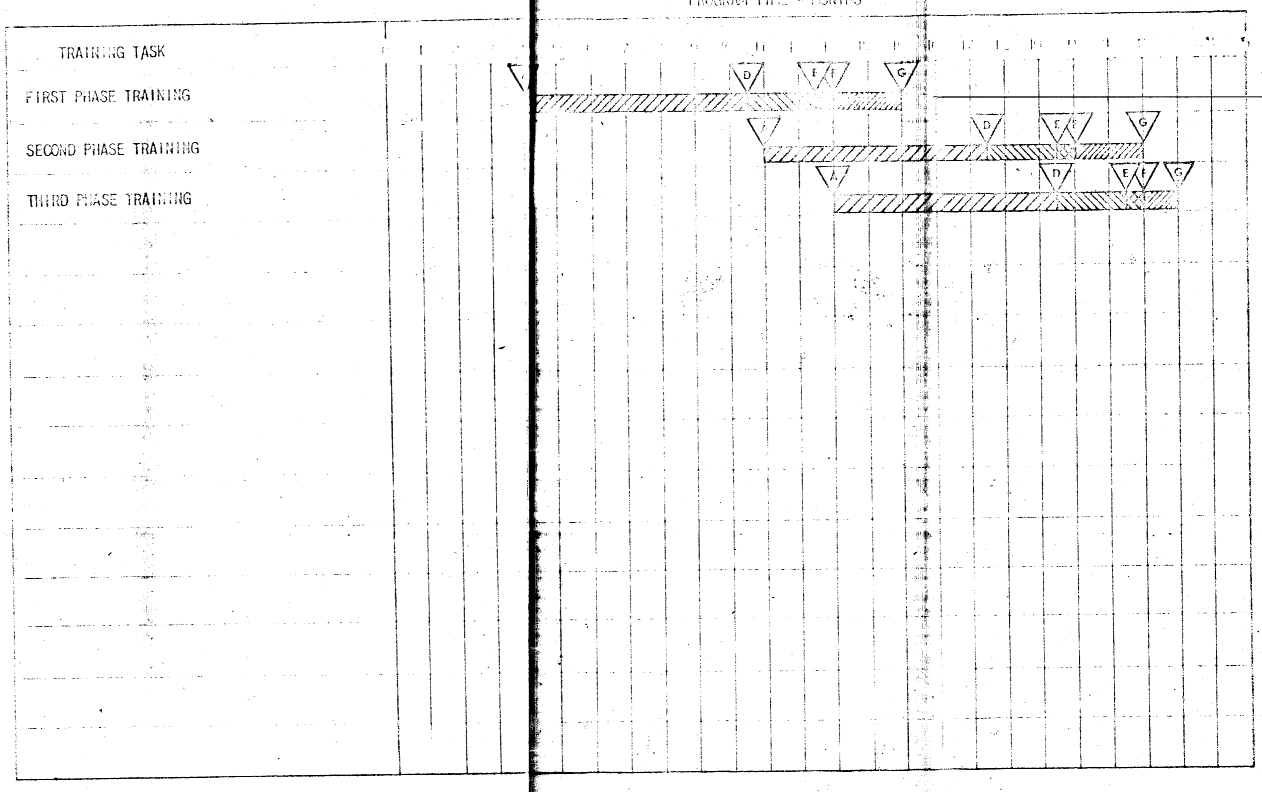

Figure 7 Training Schedule

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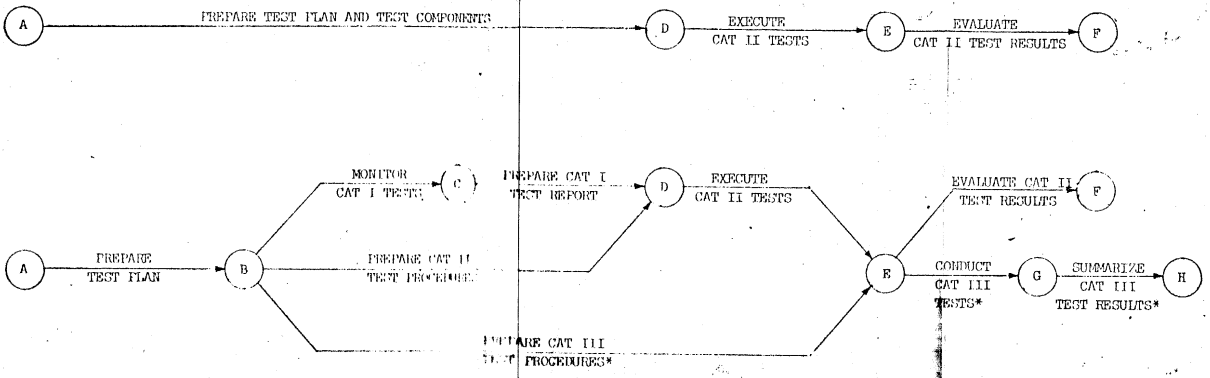

MILESTONES

A -- RELEASE SPECS
B -- OVERALL TEST PLAN PREPARED
C -- CAT I TESTS COMPLETE
D -- CAT II TESTS START*
E -- CAT III TESTS START*
F -- COMPONENT TEST PROGRAM COMPLETED
G -- CAT III TESTS COMPLETED
H -- TEST PROGRAM COMPLETED

*These items shared with other components.

CRITICAL PATH

A, B, D

TIMING IN MONTHS

TASK	TIME
A-B	3
B-C	2
B-D	6
B-E	VARIES
C-D	1/2
D-E	VARIES
E-F	VARIES
E-G	VARIES
G-H	VARIES
A-D	9

Basic Test and Evaluation Cycle

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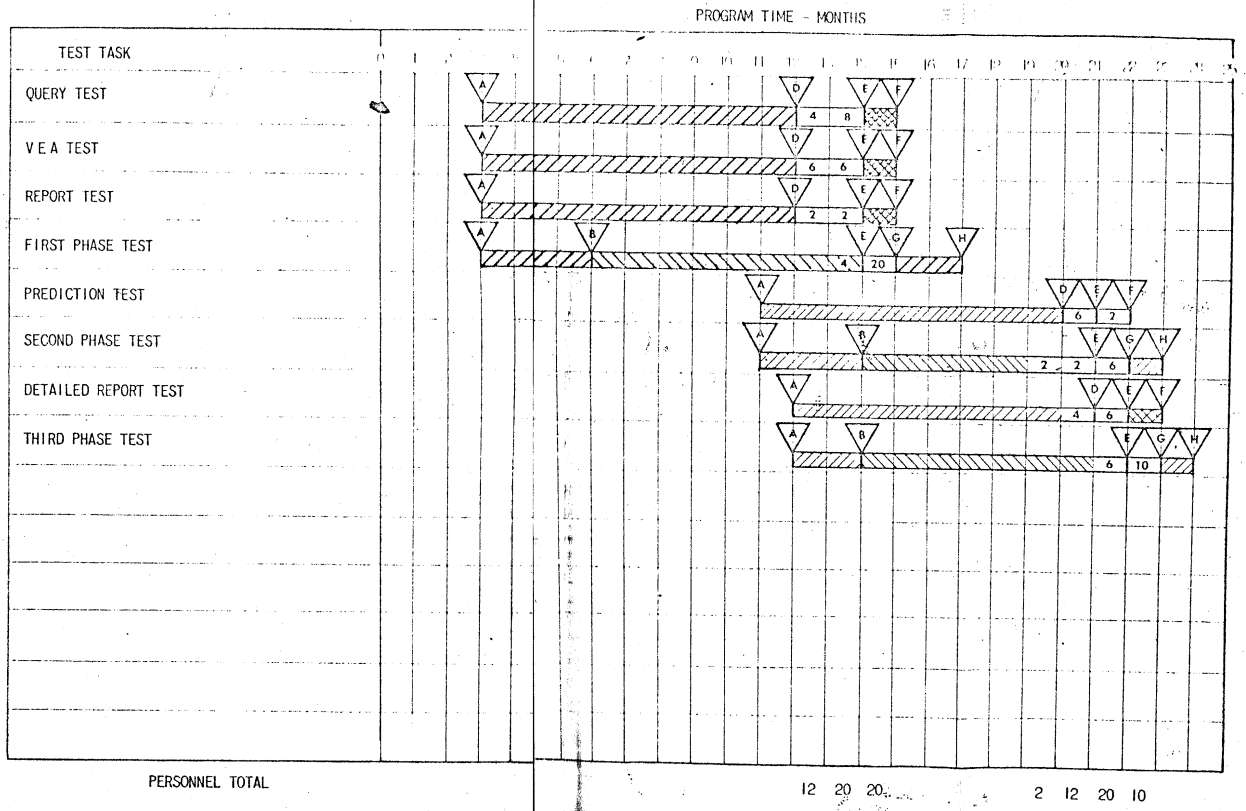

Figure [illegible] Test and Evaluation Schedule

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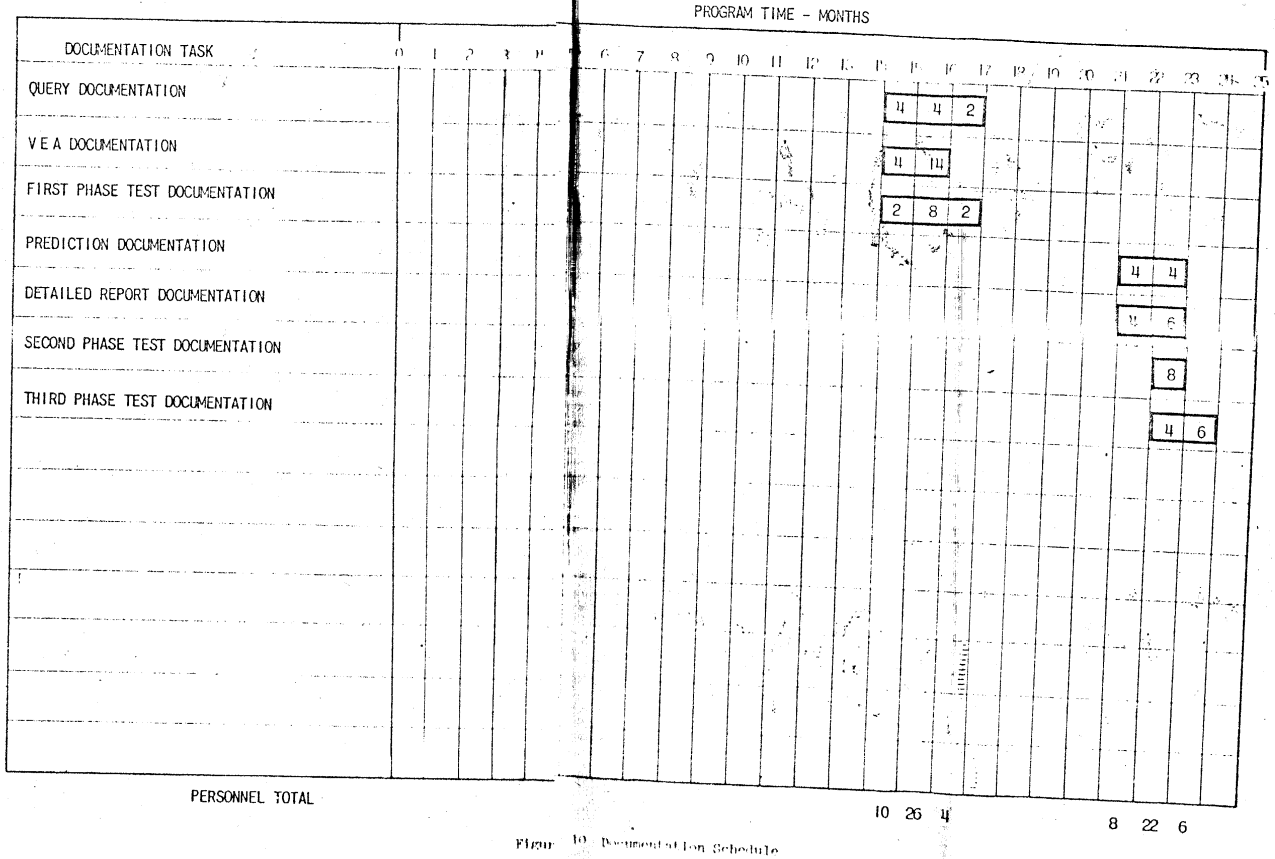

Figure 10 Documentation Schedule

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4. SYSTEM IMPLEMENTATION COSTS

Cost of system implementation are considered to include the costs of (1) operating the Program Office, (2) preparing, testing and documenting the necessary computer programs and, (3) procuring and installing new equipment. A summary of these costs, on a monthly basis during the 24-month implementation period is provided in Table II. Personnel cost extimates are based on required man-months and typical Contractor rates. Costs for data-base development and training have not been considered for the reasons given in Section 4.4 below.

4.1 Program Office

As was stated in Section 3.0, manpower loadings for the Program Office are a matter of Center organization and policy and the required effort may be divided among a number of organizational elements. We have, however, estimated a monthly dollar cost for the maintenance of such an office, as described in Section 2, based on experience in the implementation of other systems and again using typical Contractor rates.

4.2 Acquisition of Software

The estimates for contract personnel costs in software development, testing, and system installation are based on the IIS design specified in the Final Report and the implementation schedule contained in Section 3.

4.3 Acquisition of Hardware

The summary of equipment costs in Table II makes no allowance for potential credit for the "trade-in" value of existing equipment no longer used. There are two reasons for this: first, the amount and value of such equipment is comparatively small and, second, there appears to be an excellent possibility that much of it might be directed to other purposes within the Center or retained in support of manual backup procedures.

The major peak in the expenditure rate occurs in the eleventh month. This is directly caused by the fact that almost all major items of purchased equipment are installed at that time in preparation for the Category II and Category III testing that must precede the First Operational Phase which begins in the fourteenth month.

The equipment requirements of the IIS include UNIVAC 494 computer equipment already in inventory, new computer equipment which must be acquired, and consoles of various types. Equipment already in inventory which will be employed in the IIS design is not considered as an IIS implementation cost factor. The cost for new computer equipment and

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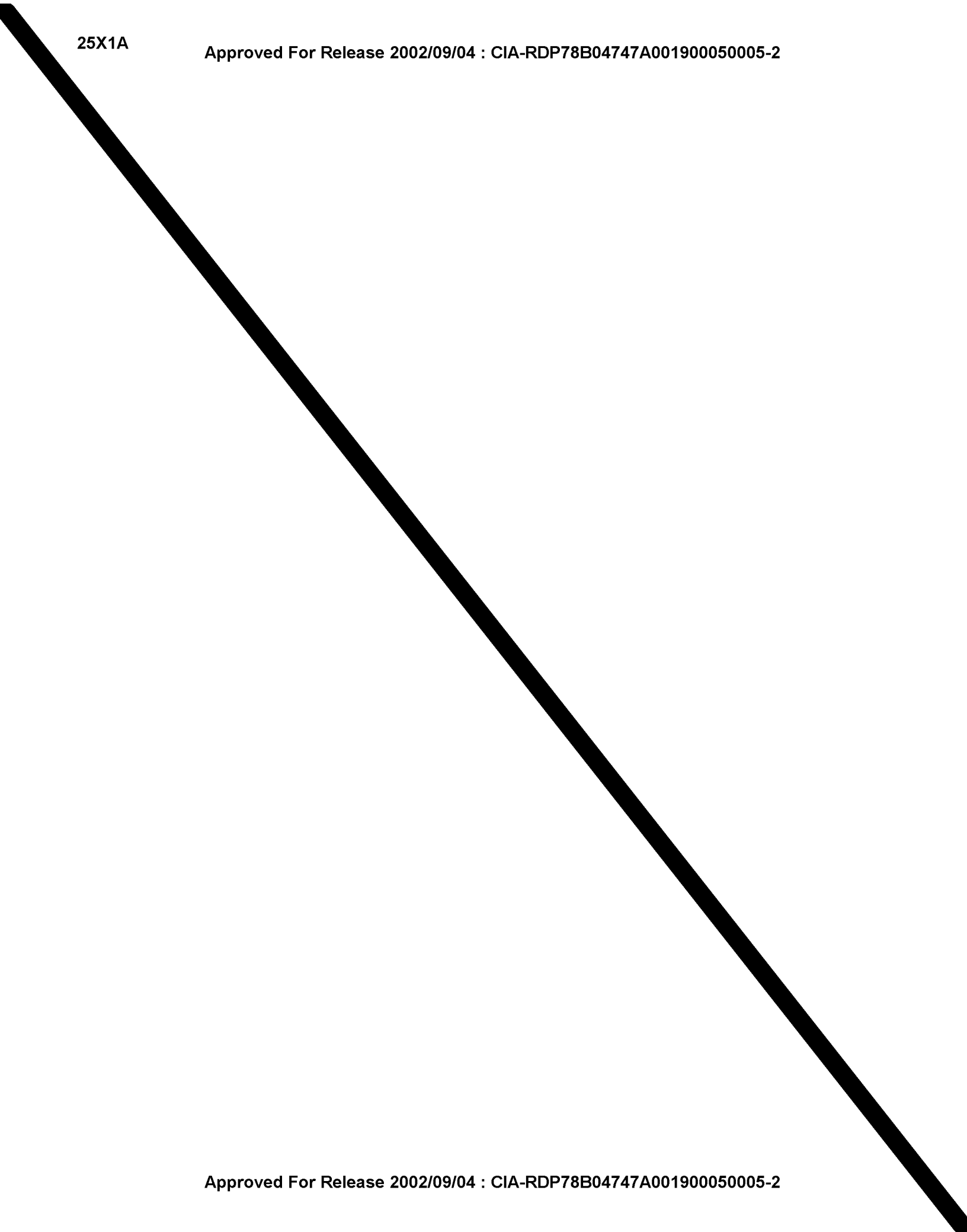

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consoles are shown in Table III. Equipment costs are shown either as purchase prices or as monthly rental costs. In either case, monthly maintenance costs are shown as separate items.

4.4 Data Base Development and Training

The requirements for data base development and training may or may not be chargeable as IIS implementation expense. The development of plans for these activities, the automatic conversion of parts of the current records into IIS format, and the acquisition and/or preparation of training manuals are costed in the estimates of personnel costs for these Program Office functions, but operational personnel will be required in additional data base conversion activities and the conduct of training (instructor and student time). These additional personnel have not been charged to IIS implementation costs because:

1. Data base conversion to meet the requirements of the NTP is required in any case and will be accomplished as a routine Center operation. The definition of the conversion required must await COMIREX identification of the content and required retrieval capabilities of the National Data Base.

2. Training could be accomplished as an OJT effort. Decision as to the method of training to be employed may be affected by existing operational requirements.

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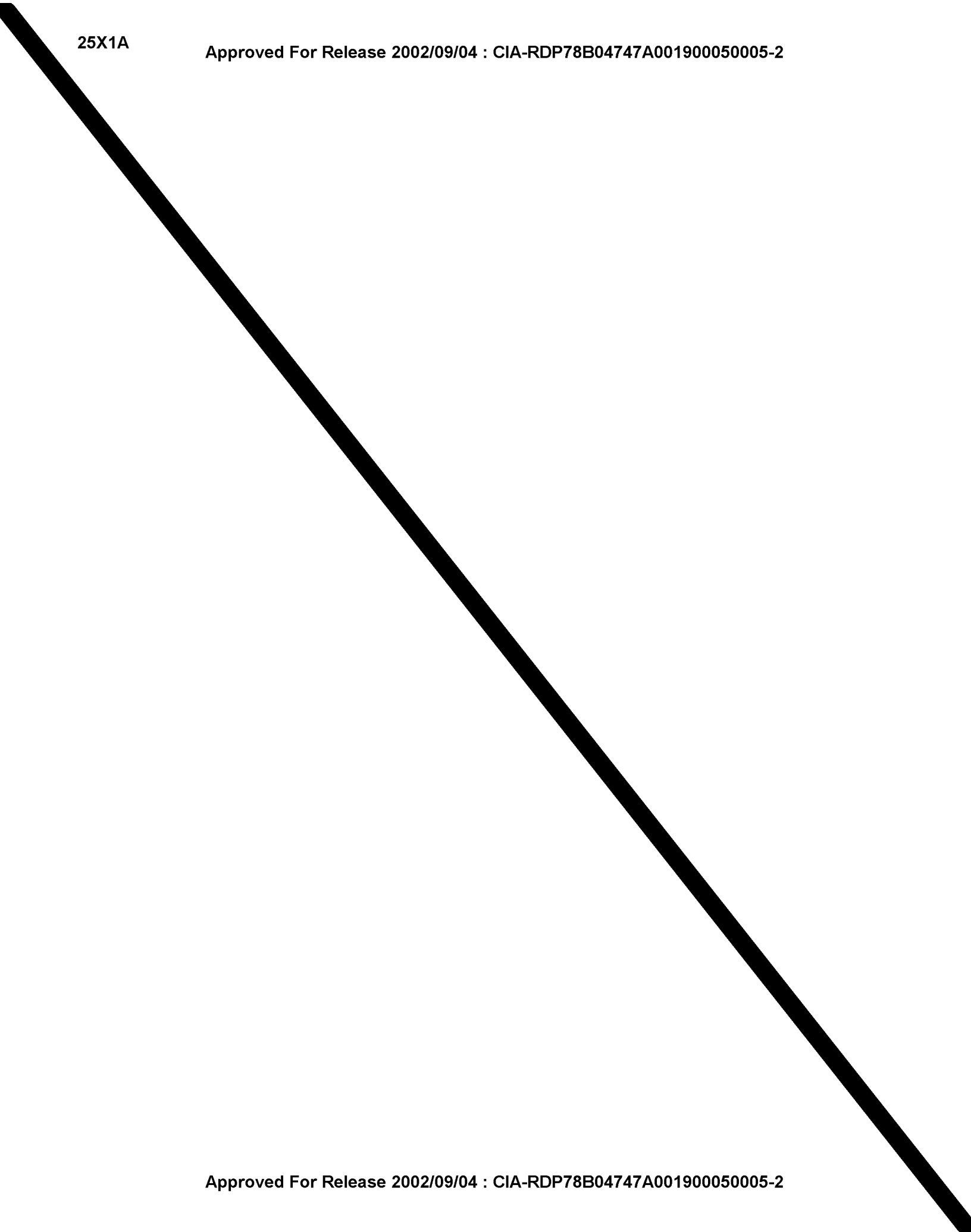

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APPENDIX A

SELECTION OF IIS IMPLEMENTATION PLAN

The operational implementation of a system of the size of the IIS must necessarily take into account the available annual funding levels, and within the limits established by these levels provide for at least partial operational capability as quickly as the required components can be installed and tested.

Furthermore, the order in which the partial capabilities are made operational should be responsive to the user's most critical requirements. The order of implementation presented in this plan evolved from a series of discussions between [redacted] personnel and the NPIC Technical Monitor and his staff and provided for the following:

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a) The initial operational capabilities of the system should support COMIREX by establishing the IDF as an operationally usable data base.

b) The ability to obtain information from this data base using the IIS Query capability should be established next.

c) The system should then grow to encompass the entire spectrum of capabilities described in the system design.

The discussions also resulted in the definition of three additional factors to be taken into account during implementation planning:

a) The manpower required to staff the Program Office was not to be directly considered.

b) The number of personnel to be utilized in programming and associated tasks was to remain essentially constant over the entire implementation period.

c) The IDF capability should be available within a time span of less than one year.

Within these ground rules, the Contractor agreed to consider three different modes of operation of the central computer complex, all of which would provide the required IDF capability in the desired time span.

Mode I is the simplest case and establishes the IDF as a tape file which would be operated upon using techniques available under the TIPS system.

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Mode II places the IDF on a random access storage device (e.g., Fastrand II drum) and operates against the file using batched queries under the RUM/ART system.

Mode III uses the same type of storage as Mode II for the IDF but operates against the file using the real-time techniques designed for the IIS.

Implementation schedules were then developed for all three modes in sufficient detail to permit estimates to be made of the total manpower and elapsed time required, and to ascertain if any significant implementation problems would exist.

A summary of the results of the further investigation of three modes is given in Tables A-I and A-II. Table A-I shows how the operation at NPIC would be affected if different central processor modes were selected. The System Characteristics listed are those that would exist between the time of the Initial IDF capabilities and the time of the 1st Operational Phase. The significance of the entries in Table A-II is described in the following paragraphs.

Mode I - It was determined that a time period of appoximately 10 months would be required to develop the IDF capability under TIPS. In order to do this, approximately 12 people would be required. If these 12 people continued to be employed in developing the IIS, the total implementation would require approximately 74 months. It was also ascertained that significant amounts of software developed during the first 10 months of the program would no longer be applicable when the IDF was transferred to the Drum Storage devices of the IIS and would have to be redone. The assignment of additional personnel to the development of the system in this mode appeared to be unwise since a version of Mode II could be developed with 16 people.

Mode II - With 16 people as the minimum number (Mode II Slow), an IDF capability could be developed under ART in approximately 10.5 months. These 16 people could successfully implement the entire IIS in approximately 52 months. In this mode, it appears that approximately 4 percent of the total implementation effort would be expended in developing computer programs and operational procedures which would not be used in the operational IIS.

Increasing the manpower to 28 people during the development activities (Mode II Fast) could shorten the entire IIS development time to about 30 months. The utilization of more than 28 people did not seem justified in view of the fact that the development of the IIS under Mode III would be more efficient if 36 people were available.

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TABLE A-I

SYSTEM CHARACTERISTICS AT TIME OF INITIAL IDF CAPABILITIES

	MODE				
	I	II Slow and Fast	III Slow	III Fast	III Modified
Presentations	BLIPS	BLIPS	BLIPS	IIS	IIS
I and II Reports	Old System	Old System	Old System	IIS[1]	IIS
Prediction	Strips	Strips	Strips	Strips	Strips
IDF	Tape	Drum	Drum	Drum	Drum
Queries	Batched Under TIPS	Batched Under ART	IIS	IIS	IIS
Worksheets	Old Form	Intermediate[2] Worksheet	Intermediate[2] Worksheet	IIS Worksheet	IIS Worksheet
Field Reports	Old Form	Old Form	Old Form	New[1]	IIS Worksheet
Data Entry	826	826	826	IIS Data Entry[1]	IIS Data Entry
Update	Reconvert[2]	Reconvert[2] Changed Rec'ds	IIS	IIS	IIS
Data Deletion	Reconvert[2]	Reconvert[2] Changed Rec'ds	IIS	IIS	IIS

NOTES:

1 Within two months of IDF Capability

2 Temporary technique to solve operational necessities

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TABLE A-II

MANPOWER LOADING AND TIMING OF CAPABILITIES

	MODE					
	I	II Slow	II Fast	III Slow	III Fast	III Modified
Software Personnel	12	16	28	36	50	36
Timing (months from start of program)						
IDF Capability	10	11	11	11	11	14
IIS Query Capability	--	22	17	11	11	14
1st Operational Phase	--	34	20	22	13	14
2nd Operational Phase	--	46	28	23	16	22
3rd Operational Phase	74	52	30	23	16	24

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Mode III - With 36 people developing the IIS under the Mode III Slow concept, the entire implementation could be completed in approximately 23 months. The IDF capability and the IIS Query capability would be available at 11 months and the remainder of the operational capabilities near the end of the development cycle. The addition of more people (Mode III Fast) would speed up the completion of the development cycle.

The apparent inconsistency between the timing of the 1st Operational Phase under Modes II Fast and III Slow is caused by the effects on III Slow of the constraint that the IDF capability be available in less than one year. It was agreed to investigate the effect on Mode III Slow of relaxing this constraint. The result of the investigation is shown on Figure A-II as "Mode III Modified". This indicates that, with 36 people, the IDF capability and the 1st Operational Phase could both be made available in 14 months. It was agreed with the NPIC Technical Monitor this mode should be expanded to become the Detailed Implementation Plan for the IIS.

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APPENDIX B

IMPLEMENTATION REQUIREMENTS PLANNING SHEETS

This appendix contains a reproduction of the basic Implementation Requirements Planning Sheets utilized in deriving the schedules of Section 3 of this report and the CPM material of Appendix C. These forms also act as a cross reference between the implementation plan and the IIS system design as described in Part I, Volume 2, of the system design report.

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP Prediction (Pre-Readout Activity) SHEET___OF___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
22	32	1.1.1.X	Determine Coverage Rectangles		
32	50	1.1.2.X	Coverage Prediction	126	60
22	34	1.1.7.X	Coordinate Prediction	84	40
		1.1.8.X	Target Can Number Match		
22	36	1.1.9.X	Sort List by Pass Coordinate Order	42	8
0	14	1.1.10.X	Generate Status List	21	4
0	20	None	Strips Method	42	8

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP		Data Entry		SHEET___OF___	
ACTIVITY NUMBER		SYSTEM	SYSTEM	CLOCK TIME	RELATIVE
START	STOP	PROCESS NUMBER	PROCESS NAME	DAYS)	C T
0	8	1.4.1.X	Add Target to Queue List	42	16
0	18	1.4.2.X	Enter Readout in W.F. & Change Status		
		1.4.3.X	Insert Information	147	32
22	30	2.2.1.X	Create Basic Report Working File		
30	40	3.3.1.X	Select Reports for Data Base Update	63	12

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: IIS Executive Program — SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
0	4	none	RT/3	231	144
8	18				

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: Photo Reference File

SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
0	13	None	Pull from the Ephemeris 1° Square Index by Mission & Pass	42	12
0	13	None	Place M & P # in 1° Square Index and Merge	21	4
0	13	None	Determine Area Coverage by 1° Squares	42	12
0	13	None	Pull entries from Photo Reference File	21	4
0	13	None	From MPF pull Ephemeris Data	21	4
0	13	None	Do fine Calculation and pull frame #'s	63	20

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: Special One Time Programs — SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
0	2	none	Develop Program To Convert TBF Baskets To IDF Sectors	42	16
2	6	none	Develop Program To Convert TBF Header Tape Into IDF Header Sector	21	6
0	14	none	Develop Program To Accept Keyed in Target Data To Be Used in Presentation Generation	42	8

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: Miscellaneous Utility — SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
0	7	none	Utility Initial Loader Backup Loader	42	8
0	7	none	Periodic Update Repack Fastrands Update Master Tape Purge Random Access Maintain Index Records	105	40
0	7	none	Backup Drum to Drum to Tape Transaction Tape for use with Master Tape Load	105	40

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP		Automatic Update		SHEET___OF___	
ACTIVITY NUMBER		SYSTEM	SYSTEM	CLOCK	RELATIVE
START	STOP	PROCESS NUMBER	PROCESS NAME	TIME (DAYS)	( )
0	9	3.1.3.X 3.1.4.X	Create File Add Data For File	126	52
0	9	3.1.5.X 3.1.6.X	Delete Data Modify Index	147	68

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: File Control

SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
0	9	None	Control Access To: National Data Base Queue List Working File	252	80

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP		VEA		SHEET___OF___	
ACTIVITY NUMBER		SYSTEM	SYSTEM	CLOCK TIME	RELATIVE
START	STOP	PROCESS NUMBER	PROCESS NAME	(DAYS)	COST
		1.4.4.X	Verify Displayed Readout		
		1.4.5.X	Edit Verified Readout		
		1.4.6.X	Approve Edit Readout		
0	10	1.4.7.X	Select Data for Data Base	210	90
		2.2.2.X	Verify Entered Material		
		2.2.3.X	Edit Verified Material		
22	30	2.2.4.X	Approve Edit Material		
30	40	2.2.5.X	Select Material for Data Base	63	24

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: Query Language — SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
0	6	3.2.5.X	Display to User		
6	15	3.2.3.X	Decode Query		
		3.2.4.X	Retrieve Required Information	294	184
22	46	3.2.6.X	Route to COINS Switch	63	12

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: Presentation Language SHEET___OF___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
18	58	none	none	168	92

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

IMPLEMENTATION GROUP: Report Generation — SHEET ___ OF ___

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
		1.8.1.X	Sort Status List Into Report Order		
0	12	1.8.2.X	Extract Sterile Targets		
12	20	1.8.3.X	Generate Index		
		1.8.4.X	Assemble Text		
		1.8.5.X	Edit Text		
		1.8.6.X	Prepare Mats for PSD	210	80
22	28	1.8.7.X	Assemble Cable Version	42	8
22	30	2.3.1.X	Change Selective Sections of Report	63	20
30	40	2.3.2.X	Prepare Proof Copy of Text		
		2.3.4.X	Prepare Mats and Store Report Text		
28	58	1.5.X	Cable Text Preparation	42	8

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IMPLEMENTATION REQUIREMENTS PLANNING SHEET

SHEET___OF___

IMPLEMENTATION GROUP: Computation Support Package (Assignment)

ACTIVITY NUMBER START	ACTIVITY NUMBER STOP	SYSTEM PROCESS NUMBER	SYSTEM PROCESS NAME	CLOCK TIME (DAYS)	RELATIVE COST
22	36	1.1.3.X	Sort Phase I and Phase II Targets	42	16
36	50	1.1.12.X	Film Can Assignment		
22	44	1.1.4.X	Maintain PI Map File	21	4
22	42	1.1.5.X	Compute Expected Team Workload	42	16
		11.13.X	Prepare Update Data		
0	14	1.1.11.X	Print PI Presentation Sheets	63	12

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APPENDIX C

APPLICATION OF CPM TO IIS SCHEDULING

This appendix contains an arrow diagram as shown in Figure C-1 prepared to illustrate the interrelationships between tasks in software development, testing and documentation. In addition, a CPM Run-off of these tasks is supplied as shown in Table C-I.

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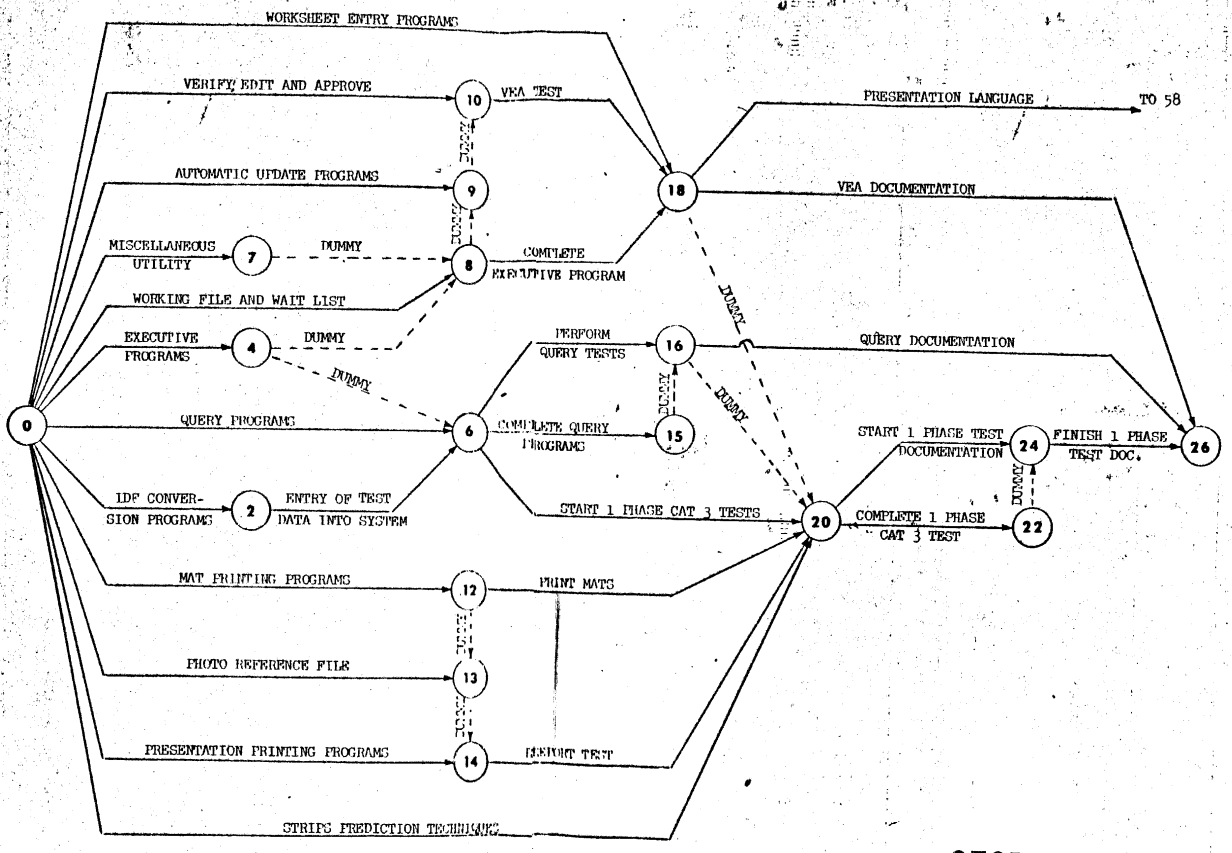

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Figure C-1 CIM Arrow Diagram

C-2

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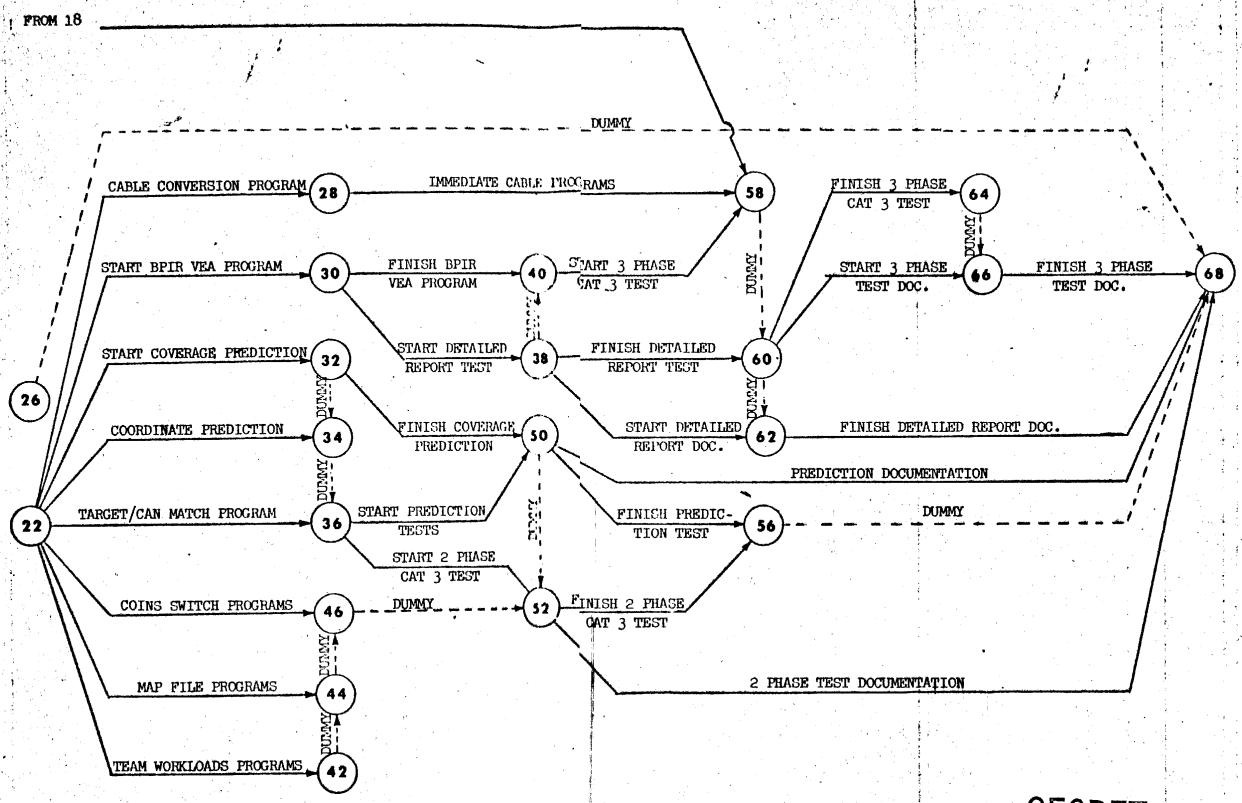

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Figure C-1 CPM Arrow Diagram

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I I S CPM FOR COMPUTER PROGRAMS TEST AND DOCUMENTATION

ACTIVITY I	ACTIVITY J	DUR	COST	ACTIVITY DESCRIPTION	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	TOTAL FLOAT	FREE FLOAT
0	2	42	16.	IDF CONVERSION PROGRAMS	0	42	199	241	199	0
0	4	252	264.	EXECUTIVE PROGRAMS	0	252	0	252	0	0
0	6	252	176.	QUERY PROGRAMS	0	252	21	273	21	0
0	7	252	88.	MISCELLANEOUS UTILITY	0	252	0	252	0	0
0	8	63	16.	WORKING FILE AND WAIT LIST	0	63	189	252	189	189
0	9	210	280.	AUTOMATIC UPDATE PROGRAMS	0	210	42	252	42	42
0	10	252	90.	VERIFY EDIT AND APPROVE	0	252	0	252	0	0
0	12	231	48.	MAT PRINTING PROGRAMS	0	231	42	273	42	0
0	13	252	56.	PHOTO REFERENCE FILE	0	252	21	273	21	0
0	14	126	24.	PRESENTATION PRINTING PROGRAMS	0	126	147	273	147	126
0	18	147	32.	WORKSHEET ENTRY PROGRAMS	0	147	147	294	147	147
0	20	42	8.	STRIPS PREDICTION TECHNIQUES	0	42	273	315	273	252
2	6	32	6.	ENTRY OF TEST DATA INTO SYSTEM	42	74	241	273	199	178
4	6	0	.	DUMMY	252	252	273	273	21	0
4	8	0	.	DUMMY	252	252	252	252	0	0
6	15	42	8.	COMPLETE QUERY PROGRAMS	252	294	273	315	21	0
6	16	42	24.	PERFORM QUERY TESTS	252	294	273	315	21	0
6	20	21	8.	START 1 PHASE CAT 3 TESTS	252	273	294	315	42	21
7	8	0	.	DUMMY	252	252	252	252	0	0
8	9	0	.	DUMMY	252	252	252	252	0	0
8	18	42	24.	COMPLETE EXECUTIVE PROGRAM	252	294	252	294	0	0
10	10	0	.	DUMMY	252	252	252	252	0	0
10	18	42	24.	VEA TEST	252	294	252	294	0	0
12	13	0	.	DUMMY	231	231	273	273	42	21
12	20	42	32.	PRINT MATS	231	273	273	315	42	21
13	14	0	.	DUMMY	252	252	273	273	21	0
14	20	42	8.	REPORT TEST	252	294	273	315	21	0
15	16	0	.	DUMMY	294	294	315	315	21	0
16	20	0	.	DUMMY	294	294	315	315	21	0
16	26	63	20.	QUERY DOCUMENTATION	294	357	441	504	147	0
18	20	0	.	DUMMY	294	294	315	315	21	0
18	26	42	36.	VEA DOCUMENTATION	294	336	462	504	168	21
18	58	168	92.	PRESENTATION LANGUAGE	294	462	294	462	0	0
20	22	21	40.	COMPLETE 1 PHASE CAT 3 TEST	294	315	315	336	21	0
20	24	21	4.	START 1 PHASE TEST DOCUMENTATION	294	315	441	462	147	0
22	24	0	.	DUMMY	315	315	462	462	147	0
22	28	42	8.	CABLE VERSION PROGRAM	315	357	378	420	63	0
22	30	84	52.	START BPIR VEA PROGRAM	315	399	336	420	21	0
22	32	105	48.	START COVERAGE PREDICTION	315	420	336	441	21	0
22	34	84	48.	COORDINATE PREDICTION	315	399	357	441	42	21
22	36	63	24.	TARGET/CAN MATCH PROGRAM	315	378	378	441	63	42
22	42	63	16.	TEAM WORKLOADS PROGRAMS	315	378	420	483	105	0
22	44	21	4.	MAP FILE PROGRAMS	315	336	462	483	147	42
22	46	63	12.	COINS SWITCH PROGRAMS	315	378	420	483	105	0
24	26	42	20.	FINISH 1 PHASE TEST DOC	315	357	462	504	147	0
26	68	0	.	DUMMY	357	357	504	504	147	147
28	58	42	8.	IMMEDIATE CABLE PROGRAMS	357	399	420	462	63	63
30	38	21	8.	START DETAILED REPORT TEST	399	420	420	441	21	0
30	40	21	4.	FINISH BPIR VEA PROGRAM	399	420	420	441	21	0
32	34	0	.	DUMMY	420	420	441	441	21	0

Figure C-2 Output From CPM Calculations Run

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I I S CPM FOR COMPUTER PROGRAMS TEST AND DOCUMENTATION

ACTIVITY I	ACTIVITY J	DUR	COST	ACTIVITY DESCRIPTION	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	TOTAL FLOAT	FREE FLOAT
32	50	21	12.	FINISH COVERAGE PREDICTION	420	441	441	462	21	0
34	36	0	.	DUMMY	420	420	441	441	21	0
36	50	21	12.	START PREDICTION TESTS	420	441	441	462	21	0
36	52	42	8.	START 2 PHASE CAT 3 TEST	420	462	441	483	21	0
38	40	0	.	DUMMY	420	420	441	441	21	0
38	60	21	12.	FINISH DETAILED REPORT TEST	420	441	441	462	21	0
38	62	21	8.	START DETAILED REPORT DOC	420	441	462	483	21	21
40	58	21	12.	START 3 PHASE CAT 3 TEST	420	441	441	462	42	21
42	44	0	.	DUMMY	378	378	483	483	105	0
44	46	0	.	DUMMY	378	378	483	483	105	0
46	52	0	.	DUMMY	378	378	483	483	105	84
50	52	0	.	DUMMY	441	441	483	483	42	21
50	56	21	4.	FINISH PREDICTION TEST	441	462	483	504	42	21
50	68	42	28.	PREDICTION DOCUMENTATION	441	483	462	504	21	21
52	56	21	12.	FINISH 2 PHASE CAT 3 TEST	462	483	483	504	21	0
52	68	21	16.	2 PHASE TEST DOCUMENTATION	462	483	483	504	21	21
56	68	0	.	DUMMY	483	483	504	504	21	21
58	60	0	.	DUMMY	462	462	462	462	0	0
60	62	0	.	DUMMY	462	462	483	483	21	0
60	64	21	28.	FINISH 3 PHASE CAT 3 TEST	462	483	462	483	0	0
60	66	21	8.	START 3 PHASE TEST DOC	462	483	483	504	21	21
62	68	21	8.	FINISH DETAILED REPORT DOC	483	504	483	504	0	0
64	66	0	.	DUMMY	483	504	504	504	0	0
66	68	21	12.	FINISH 3 PHASE TEST DOC	504	504	504	504	0	0
68	69	0	.	DUMMY						
PROJECT COST			1752.	PROJECT COMPLETION						

Figure C-2 Output From CPM Calculations Run

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I I S CPM FOR COMPUTER PROGRAMS TEST AND DOCUMENTATION

5 DAY WORKWEEK

ACTIVITY I	ACTIVITY J	ACTIVITY DUR	ACTIVITY COST	ACTIVITY DESCRIPTION	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	TOTAL FLOAT	FREE FLOAT
0	2	42	16.	IDF CONVERSION PROGRAMS	JAN 1,68	FEB 29,68	OCT 9,68	DEC 18,68	199	0
0	4	252	264.	EXECUTIVE PROGRAMS	JAN 1,68	DEC 26,68	JAN 1,68	DEC 26,68	0	0
0	6	252	176.	QUERY PROGRAMS	JAN 1,68	DEC 26,68	JAN 30,68	JAN 24,69	21	0
0	7	252	88.	MISCELLANEOUS UTILITY	JAN 1,68	DEC 26,68	JAN 1,68	DEC 26,68	0	0
0	8	63	16.	WORKING FILE AND WAIT LIST	JAN 1,68	MAR 29,68	SEP 26,68	DEC 26,68	189	189
0	9	210	200.	AUTOMATIC UPDATE PROGRAMS	JAN 1,69	OCT 24,68	FEB 29,68	DEC 26,68	42	42
0	10	252	90.	VERIFY EDIT AND APPROVE	JAN 1,68	DEC 26,68	JAN 1,68	DEC 26,68	0	0
0	12	231	48.	MAT PRINTING PROGRAMS	JAN 1,68	NOV 25,68	FEB 29,68	JAN 24,69	42	0
0	13	252	56.	PHOTO REFERENCE FILE	JAN 1,68	DEC 26,68	JAN 30,68	JAN 24,69	21	0
0	14	126	24.	PRESENTATION PRINTING PROGRAMS	JAN 1,68	JUN 27,68	JUL 29,68	JAN 24,69	147	126
0	18	147	32.	WORKSHEET ENTRY PROGRAMS	JAN 1,68	JUL 29,68	JUL 29,68	FEB 25,69	147	147
0	20	42	8.	STRIPS PREDICTION TECHNIQUES	JAN 1,68	FEB 29,68	JAN 24,69	MAR 26,69	273	252
2	6	32	6.	ENTRY OF TEST DATA INTO SYSTEM	FEB 29,68	APR 15,68	DEC 18,68	JAN 24,69	199	178
4	6	0	.	DUMMY	DEC 26,68	DEC 26,68	JAN 24,69	JAN 24,69	21	0
4	8	0	.	DUMMY	DEC 26,68	DEC 26,68	DEC 26,68	DEC 26,68	0	0
6	15	42	8.	COMPLETE QUERY PROGRAMS	DEC 26,68	FEB 25,69	JAN 24,69	MAR 26,69	21	0
6	16	42	24.	PERFORM QUERY TESTS	DEC 26,68	FEB 25,69	JAN 24,69	MAR 26,69	21	0
6	20	21	8.	START 1 PHASE CAT 3 TESTS	DEC 26,68	JAN 24,69	FEB 25,69	MAR 26,69	42	21
7	8	0	.	DUMMY	DEC 26,68	DEC 26,68	DEC 26,68	DEC 26,68	0	0
8	9	0	.	DUMMY	DEC 26,68	DEC 26,68	DEC 26,68	DEC 26,68	0	0
8	18	42	24.	COMPLETE EXECUTIVE PROGRAM	DEC 26,68	FEB 25,69	DEC 26,68	FEB 25,69	0	0
9	10	0	.	DUMMY	DEC 26,68	DEC 26,68	DEC 26,68	DEC 26,68	0	0
10	18	42	24.	VEA TEST	DEC 26,68	FEB 25,69	DEC 26,68	FEB 25,69	0	0
12	13	0	.	DUMMY	NOV 25,68	NOV 25,68	JAN 24,69	JAN 24,69	42	21
12	20	42	32.	PRINT MATS	NOV 25,68	JAN 24,69	JAN 24,69	MAR 26,69	42	21
13	14	0	.	DUMMY	DEC 26,68	DEC 26,68	JAN 24,69	JAN 24,69	21	0
14	20	42	8.	REPORT TEST	DEC 26,68	FEB 25,69	JAN 24,69	MAR 26,69	21	0
15	16	0	.	DUMMY	FEB 25,69	FEB 25,69	MAR 26,69	MAR 26,69	21	0
16	20	0	.	DUMMY	FEB 25,69	FEB 25,69	MAR 26,69	MAR 26,69	21	0
16	26	63	20.	QUERY DOCUMENTATION	FEB 25,69	MAY 23,69	SEP 22,69	DEC 22,69	147	0
18	20	0	.	DUMMY	FEB 25,69	FEB 25,69	MAR 26,69	MAR 26,69	21	0
18	26	42	36.	VEA DOCUMENTATION	FEB 25,69	APR 24,69	OCT 21,69	DEC 22,69	168	21
18	58	168	92.	PRESENTATION LANGUAGE	FEB 25,69	OCT 21,69	FEB 25,69	OCT 21,69	0	0
20	22	21	40.	COMPLETE 1 PHASE CAT 3 TEST	FEB 25,69	MAR 26,69	MAR 26,69	APR 24,69	21	0
20	24	21	4.	START 1 PHASE TEST DOCUMENTATION	FEB 25,69	MAR 26,69	SEP 22,69	OCT 21,69	147	0
22	24	0	.	DUMMY	MAR 26,69	MAR 26,69	OCT 21,69	OCT 21,69	147	0
22	28	42	8.	CABLE VERSION PROGRAM	MAR 26,69	MAY 23,69	JUN 24,69	AUG 22,69	63	0
22	30	84	52.	START BPIR VEA PROGRAM	MAR 26,69	JUL 24,69	APR 24,69	AUG 22,69	21	0
22	32	105	48.	START COVERAGE PREDICTION	MAR 26,69	AUG 22,69	APR 24,69	SEP 22,69	21	0
22	34	84	48.	COORDINATE PREDICTION	MAR 26,69	JUL 24,69	MAY 23,69	SEP 22,69	42	21
22	36	63	24.	TARGET/CAN MATCH PROGRAM	MAR 26,69	JUN 24,69	JUN 24,69	SEP 22,69	63	42
22	42	63	16.	TEAM WORKLOADS PROGRAMS	MAR 26,69	JUN 24,69	AUG 22,69	NOV 28,69	105	0
22	44	21	4.	MAP FILE PROGRAMS	MAR 26,69	APR 24,69	OCT 21,69	NOV 28,69	147	42
22	46	63	12.	COINS SWITCH PROGRAMS	MAR 26,69	JUN 24,69	AUG 22,69	NOV 28,69	105	0
24	26	42	20.	FINISH 1 PHASE TEST DOC	MAR 26,69	MAY 23,69	OCT 21,69	DEC 22,69	147	0
26	68	0	.	DUMMY	MAY 23,69	MAY 23,69	DEC 22,69	DEC 22,69	147	147
28	58	42	8.	IMMEDIATE CABLE PROGRAMS	MAY 23,69	JUL 24,69	AUG 22,69	OCT 21,69	63	63
30	38	21	8.	START DETAILED REPORT TEST	JUL 24,69	AUG 22,69	AUG 22,69	SEP 22,69	21	0
30	40	21	4.	FINISH BPIR VEA PROGRAM	JUL 24,69	AUG 22,69	AUG 22,69	SEP 22,69	21	0
32	34	0	.	DUMMY	AUG 22,69	AUG 22,69	SEP 22,69	SEP 22,69	21	0
32	50	21	12.	FINISH COVERAGE PREDICTION	AUG 22,69	SEP 22,69	SEP 22,69	OCT 21,69	21	0

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Figure C-3 Output From Calendar Dating Run

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I I S CPM FOR COMPUTER PROGRAMS TEST AND DOCUMENTATION — 5 DAY WORKWEEK

ACTIVITY I	ACTIVITY J	ACTIVITY DUR	ACTIVITY COST	ACTIVITY DESCRIPTION	EARLIEST START	EARLIEST FINISH	LATEST START	LATEST FINISH	TOTAL FLOAT	FREE FLOAT
34	36	0	.	DUMMY	AUG 22,69	AUG 22,69	SEP 22,69	SEP 22,69	21	0
36	50	21	12.	START PREDICTION TESTS	AUG 22,69	SEP 22,69	SEP 22,69	OCT 21,69	21	0
36	52	42	8.	START 2 PHASE CAT 3 TEST	AUG 22,69	OCT 21,69	SEP 22,69	NOV 20,69	21	0
38	40	0	.	DUMMY	AUG 22,69	AUG 22,69	SEP 22,69	SEP 22,69	21	0
38	60	21	12.	FINISH DETAILED REPORT TEST	AUG 22,69	SEP 22,69	OCT 21,69	OCT 21,69	21	21
38	62	21	8.	START DETAILED REPORT DOC	AUG 22,69	SEP 22,69	SEP 22,69	NOV 20,69	42	21
40	58	21	12.	START 3 PHASE CAT 3 TEST	AUG 22,69	SEP 22,69	OCT 21,69	OCT 21,69	21	21
42	44	0	.	DUMMY	JUN 24,69	JUN 24,69	NOV 20,69	NOV 20,69	105	0
44	46	0	.	DUMMY	JUN 24,69	JUN 24,69	NOV 20,69	NOV 20,69	105	0
46	52	0	.	DUMMY	JUN 24,69	JUN 24,69	NOV 20,69	NOV 20,69	105	84
50	52	0	.	DUMMY	SEP 22,69	SEP 22,69	NOV 20,69	NOV 20,69	42	21
50	56	21	4.	FINISH PREDICTION TEST	SEP 22,69	OCT 21,69	NOV 20,69	DEC 22,69	42	21
50	68	42	20.	PREDICTION DOCUMENTATION	OCT 21,69	NOV 20,69	OCT 21,69	DEC 22,69	21	21
52	56	21	12.	FINISH 2 PHASE CAT 3 TEST	OCT 21,69	NOV 20,69	NOV 20,69	DEC 22,69	21	0
52	68	21	16.	2 PHASE TEST DOCUMENTATION	NOV 20,69	NOV 20,69	NOV 20,69	DEC 22,69	21	21
56	68	0	.	DUMMY	OCT 21,69	OCT 21,69	DEC 22,69	DEC 22,69	21	21
58	60	0	.	DUMMY	OCT 21,69	OCT 21,69	OCT 21,69	OCT 21,69	0	0
60	62	0	.	DUMMY	OCT 21,69	NOV 20,69	NOV 20,69	NOV 20,69	21	0
60	64	21	20.	FINISH 3 PHASE CAT 3 TEST	OCT 21,69	NOV 20,69	OCT 21,69	NOV 20,69	0	0
60	66	21	8.	START 3 PHASE TEST DOC	OCT 21,69	NOV 20,69	OCT 21,69	OCT 21,69	0	0
62	68	21	8.	FINISH DETAILED REPORT DOC	NOV 20,69	NOV 20,69	NOV 20,69	DEC 22,69	21	21
64	66	0	.	DUMMY	NOV 20,69	DEC 22,69	NOV 20,69	DEC 22,69	0	0
66	68	21	12.	FINISH 3 PHASE TEST DOC	DEC 22,69	DEC 22,69	DEC 22,69	DEC 22,69	0	0
68	69	0	.	DUMMY						
PROJECT COST			1752.	PROJECT COMPLETION						

Figure C-3 Output From Calendar Dating Run

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